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Exhibit C – U.S. Patent No. 6,980,537 ('537) – Claims 1-5, 10-11, 16-19, 24-25, 30-31, 33-34, 36-40, 45-49, 54-68

Harris Corporation expressly reserves the right to supplement or modify these Disclosures as appropriate upon receipt of further information and discovery. The Huawei '537 Patent Accused Products (as that term is defined and the corresponding devices are identified in Harris's P.R. 3-1 and P.R. 3-2 disclosures cover pleading) infringe at least the following claims. References to instrumentalities in this chart are exemplary only and should not be construed as limiting the scope of any claim of the '537 patent. The Huawei '537 Patent Accused Products satisfy each claim element below literally. The Huawei '537 Patent Accused Products also satisfy claim elements under the Doctrine of Equivalents, including without limitation where specifically identified below, because they include and perform substantially similar functionality.

All ***bolded italics*** emphasis added unless noted otherwise.

'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
1. In a communications network including a plurality of communication units, wherein at least one of those units is designated as a member unit for transmitting and receiving messages and at least one of those units is designated as a routing unit for routing said messages from said member units, a communication unit to transmit and receive messages within said network comprising:	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate a communications network including a plurality of communication units. For example, and without limitation: Huawei is a "Promoter" level member of the Zigbee Alliance and produces products certified by Zigbee. *See, e.g.,* Zigbee Alliance, Our Members, *available at* https://www.zigbee.org/zigbeealliance/our-members/ (last accessed March 27, 2019); Zigbee Alliance, Zigbee Certified Products, *available at* https://www.zigbee.org/zigbee-products-2/#zigbeecertifiedproducts/?view_30_search=Huawei&view_30_page=1 (last accessed March 27, 2019) The Huawei '537 Patent Accused Products comply with the Zigbee standards, including the IEEE 802.15.4 standard (defining the Medium Access Control (MAC) and Physical (PHY) sublayers for Low-Rate Wireless Personal Area Networks (LR-WPANs) connectivity), which is the basis for the MAC and PHY layers in Zigbee certified products. *See, e.g.,* Zigbee Alliance, Zigbee 3.0, *available at* https://www.zigbee.org/zigbee-for-developers/zigbee-3-0/ (last accessed March 27, 2019); *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 17-18; ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 1 ("The IEEE 802.15.4 standard defines the two lower layers:

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	the physical (PHY) layer and the medium access control (MAC) sub-layer. The ZigBee Alliance builds on this foundation by providing the network (NWK) layer and the framework for the application layer."). Figure 1 Outline ZigBee stack architecture ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at p. 18, Figure 1

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	Huawei represents that certain of its products comply with and communicate according to the Zigbee standards. For example: This topic introduces the wireless network access indicators of the ONT. Table 9-1 Zigbee/Z-Wave access indicators <table><tr><td>Indicator</td><td>Value(ZigBee)</td><td>Value(Z-Wave)</td></tr><tr><td>Standards compliance</td><td>IEEE 802.15.4 For ZHA1.2 and ZLL1.0 device management</td><td>ITU-T G.9959 For device plus management</td></tr><tr><td>Communication frequency</td><td>2.4GHz</td><td>• Australian standard: 908.4-916 MHz • U.S. standard: 919.8-921.42 MHz</td></tr></table> Echolife ONT, Port Specifications, Jan. 24, 2019, at 10. "The AR502 series IoT gateway is designed for industrial environments and supports communication in harsh environments such as extreme temperature, high humidity, and electromagnetic interference. The built-in industrial-grade LTE module supports high bandwidth, low-latency wireless access, and various local interfaces (RS485/RS422, RS232, Gigabit Ethernet and ZigBee) for connecting serial interface devices, Ethernet devices. The AR502 applies to multiple IoT fields, such as smart grid and smart transportation." Huawei AR502 Series IoT Gateway, Datasheet, at 2; *see also* Huawei AP7060DN Access Point Datasheet, *available at* https://e.huawei.com/us/related-page/products/enterprise-network/wlan/indoor-access-points/ap7060dn/wlan-ap7060dn (last accessed March 28, 2019), at 3; Huawei AR160-M Series Enterprise

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	Routers Data Sheet, *available at* https://e.huawei.com/it/related-page/products/enterprise-network/routers/ar-agile/ar160-m/router_ar160-m, at 2. Zigbee and IEEE 802.15.4 standards describe and require a wireless communication network comprising a number of mobile nodes. For example, and without limitation: **Figure 1—Star and peer-to-peer topology examples** IEEE Standard for Local and Metropolitan Area Networks – Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs), IEEE Computer Society, IEEE Std 802.15.4-2011, at p. 9, Figure 1. "A system conforming to this standard consists of several components. The most basic is the device. Two or more devices communicating on the same physical channel constitute a WPAN."

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	IEEE Std 802.15.4-2011, at p. 8 The Huawei '537 Patent Accused Products further incorporate communication units to transmit and receive messages within the network, wherein at least one of those units is designated as a member unit for transmitting and receiving messages and at least one of those units is designated as a routing unit for routing said messages from said member units. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each LR-WPAN device to include a MAC sublayer, which manages the association and disassociation of devices with the network. Devices may be a full-function device that may serve as a PAN coordinator or coordinator (e.g., a routing unit) or a reduced-function device that may only serve as an end device (e.g., a member unit). The coordinators determine the status of nodes by a procedure utilizing information from beacon messages. "An LR-WPAN device comprises . . . a MAC sublayer that provides access to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	IEEE Std 802.15.4-2011, at p. 11, Figure 3 "There are two device types: a full-function device (FFD) and a reduced-function device (RFD). The FFD may operate in three modes serving as *a personal area network (PAN) coordinator, a coordinator,* or a device. An RFD shall only operate as *a device*." IEEE Std 802.15.4-2011, at p. 18

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	5.1 MAC functional description The MAC sublayer handles all access to the physical radio channel and is responsible for the following tasks: — Generating network beacons if the device is a coordinator — Synchronizing to network beacons — Supporting PAN association and disassociation — Supporting device security — Employing the CSMA-CA mechanism for channel access — Handling and maintaining the GTS mechanism — Providing a reliable link between two peer MAC entities IEEE Std 802.15.4-2011, at p. 18 "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices. A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators . . ." IEEE Std 802.15.4-2011, at p. 10 "Once predetermined application or network requirements are met, the first PAN coordinator instructs a device to become the PAN coordinator of a new cluster adjacent to the first one. Other

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	devices gradually connect and form a multicluster network structure, such as the one seen in Figure 2. The lines in Figure 2 represent the parent-child relationships of the devices and not the communication flow." IEEE Std 802.15.4-2011, at p. 10. Figure 2—Cluster tree network

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	IEEE Std 802.15.4-2011, at p. 10, Figure 2.
[a] a transmitter to transmit an outgoing message to each neighboring unit of said communication unit;	The Huawei '537 Patent Accused Products incorporate communication units that include a transmitter to transmit an outgoing message to each neighboring unit. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each device to include a RF transceiver that transmits and receives messages. For example, and without limitation: "A system conforming to this standard consists of several components. The most basic is the device. Two or more devices communicating on the same physical channel constitute a WPAN." IEEE Std 802.15.4-2011, at p. 8.

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	"In a peer-to-peer topology, *each device is capable of communicating with any other device within its radio communications range*. One device is nominated as the PAN coordinator, for instance, by virtue of being the first device to communicate on the channel." IEEE Std 802.15.4-2011, at p. 9. "An LR-WPAN device comprises at least one PHY, which contains the radio frequency (RF) transceiver along with its low-level control mechanism, and a MAC sublayer that provides access to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11. "The PHY data service enables the transmission and reception of PHY protocol data units (PPDUs) across the physical radio channel. The general PHY requirements are described in Clause 8. The features of the PHY are activation and deactivation of the radio transceiver, ED, LQI, channel selection, clear channel assessment (CCA), and *transmitting as well as receiving packets across the physical medium*." IEEE Std 802.15.4-2011, at p. 11.
[b] a receiver to receive an incoming message from said each neighboring unit;	The Huawei '537 Patent Accused Products incorporate communication units that include a receiver to receive an incoming message from each neighboring unit. For example, and without limitation: *See* claim element 1[a] above.

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
[c] a storage unit to store network connectivity information relating to said communication unit and corresponding neighboring units; and	The Huawei '537 Patent Accused Products incorporate a storage unit to store network connectivity information relating to the communication unit and corresponding neighboring units. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each device to include a neighbor table storing network connectivity information relating to that device and its neighbors. For example, and without limitation: "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. . . . A candidate device receiving a beacon frame is able to request to join the network at the PAN coordinator. If the PAN coordinator permits the device to join, it ***adds the new device as a child device in its neighbor list***. Then the newly joined device ***adds the PAN coordinator as its parent in its neighbor list*** and begins transmitting periodic beacons; other candidate devices are able to then join the network at that device. If the original candidate device is not able to join the network at the PAN coordinator, it will search for another parent device. The detailed procedures describing how a PAN is started and how devices join a PAN are found in 5.1.2 and 5.1.3." IEEE Std 802.15.4-2011, at p. 10. "A beacon-enabled PAN is used in networks that either require synchronization or support for low latency devices, such as PC peripherals. If the network does not need synchronization or support for low latency devices, it can elect not to use the beacon for normal transfers. However, the beacon is still required for network discovery. The structure of the frames used for the data transfer is specified in 5.2." IEEE Std 802.15.4-2011, at p. 13.

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	"Otherwise, the device shall copy the relevant information from each received beacon (see Figure 3.51 for the structure of the beacon payload) into its neighbor table (see Table 3.53 for the contents of a neighbor table entry)." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 313. "The neighbor table of a device shall contain information on every device within transmission range, up to some implementation-dependent limit. The neighbor table is useful in two contexts. First of all, it is used during network discovery or rejoining to store information about routers within RF reception range that may be candidate parents. Second, after the device has joined a network, it is used to store relationship and link-state information about neighboring devices in that network. A table entry shall be updated every time a device receives any frame from the corresponding neighbor." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 319.
[d] a processor to control said transmission and reception of said outgoing and incoming messages, wherein said processor includes:	The Huawei '537 Patent Accused Products incorporate a processor to control said transmission and reception of said outgoing and incoming messages. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require network communication protocols and procedures that are implemented on a processor. For example, and without limitation: "Application profiles are agreements for messages, message formats, and processing actions that enable developers to create an interoperable, distributed application employing application entities that reside on separate devices. These application profiles enable applications to send commands, request data, and process commands and requests."

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 14. "The APS is required to maintain a minimum set of data in persistent memory. This data set shall persist over power fail, device reset, or other processing events. The following data shall be maintained in persistent memory within APS:" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 52.
[e] a configuration module to designate a status of said communication unit as one of said routing unit and said member unit to configure said communications network, wherein said configuration module includes:	The Huawei '537 Patent Accused Products incorporate communication units including configuration modules that designate a status of that communication unit as a routing unit or as a member unit to configure the communications network. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each LR-WPAN device to include a MAC sublayer, which manages the association and disassociation of devices with the network. Devices may be a full-function device that may serve as a PAN coordinator (e.g., a transmission routing unit) or coordinator (e.g., a routing unit) or a reduced-function device that may only serve as an end device (e.g., a member unit). For example, and without limitation: "An LR-WPAN device comprises . . . a MAC sublayer that provides access to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11.

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	IEEE Std 802.15.4-2011, at p. 11, Figure 3.

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	5.1 MAC functional description The MAC sublayer handles all access to the physical radio channel and is responsible for the following tasks: — Generating network beacons if the device is a coordinator — Synchronizing to network beacons — Supporting PAN association and disassociation — Supporting device security — Employing the CSMA-CA mechanism for channel access — Handling and maintaining the GTS mechanism — Providing a reliable link between two peer MAC entities IEEE Std 802.15.4-2011, at p. 18. "There are two device types: a full-function device (FFD) and a reduced-function device (RFD). The FFD may operate in three modes serving as a personal area network (PAN) coordinator, a coordinator, or a device. An RFD shall only operate as a device." IEEE Std 802.15.4-2011, at p. 18. "Any FFD is able to *act as a coordinator and provide synchronization services to other devices or other coordinators*. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	frames to neighboring devices. A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators . . ." IEEE Std 802.15.4-2011, at p. 10. "Once predetermined application or network requirements are met, the first PAN coordinator instructs a device to become the PAN coordinator of a new cluster adjacent to the first one. Other devices gradually connect and form a multicluster network structure, such as the one seen in Figure 2. The lines in Figure 2 represent the parent-child relationships of the devices and not the communication flow." IEEE Std 802.15.4-2011, at p. 10. "5.1.2.5 Device discovery The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery. A coordinator that is not the PAN coordinator shall begin transmitting beacon frames only when it has successfully associated with a PAN. The transmission of beacon frames by the device is initiated through the use of the MLME-START.request primitive with the PANCoordinator parameter set to FALSE." IEEE Std 802.15.4-2011, at p. 32. "Otherwise, the device shall copy the relevant information from each received beacon (see Figure 3.51 for the structure of the beacon payload) into its neighbor table (see Table 3.53 for the contents of a neighbor table entry)."

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 306; *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 212-13, Figure 63. Figure 3.51 Format of the MAC Sub-Layer Beacon Payload ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 362, Figure 3.51. "The beacon payload shall contain the information shown in Table 3.61. This enables the NWK layer to provide additional information to new devices that are performing network discovery and allows these new devices to more efficiently select a network and a particular neighbor to join." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 360.

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 360-61, Table 3.61 "ZigBee router: an IEEE 802.15.4 FFD participating in a ZigBee network, which is not the ZigBee coordinator but may act as an IEEE 802.15.4 coordinator within its personal operating space, that is capable of routing messages between devices and supporting associations." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 11.

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	"The responsibilities of the ZDO include defining the role of the device within the network (e.g., ZigBee coordinator or end device), initiating and/or responding to binding requests and establishing a secure relationship between network devices. The ZDO is also responsible for discovering devices on the network and determining which application services they provide" ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 17-18. "The ZigBee network layer (NWK) supports star, tree, and mesh topologies. In a star topology, the network is controlled by one single device called the ZigBee coordinator. The ZigBee coordinator is responsible for initiating and maintaining the devices on the network. All other devices, known as end devices, directly communicate with the ZigBee coordinator. In mesh and tree topologies, the ZigBee coordinator is responsible for starting the network and for choosing certain key network parameters, but the network may be extended through the use of ZigBee routers. In tree networks, routers move data and control messages through the network using a hierarchical routing strategy. Tree networks may employ beacon-oriented communication as described in the IEEE 802.15.4 specification." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 2. "ZigBee Device Objects are applications which employ network and application support layer primitives to implement ZigBee End Devices, ZigBee Routers, and ZigBee Coordinators" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 185

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
[f] a neighbor module to examine said network connectivity information and identify neighboring units of said communication unit that are isolated from communications with remaining neighboring units of said communication unit:	The Huawei '537 Patent Accused Products incorporate configuration modules including neighbor modules that examine said network connectivity information and identify neighboring units of the communication unit that are isolated from communications with remaining neighboring units of the communication unit. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that devices capable of acting as coordinators (e.g. routing units) monitor communications from neighboring units to examine network connectivity information. Upon receiving communications from neighboring units that have become orphaned, or that wish to join, a device may become a new parent routing unit for that orphaned neighboring unit. For example, and without limitation: "An RFD connects to a cluster tree network as a leaf device at the end of a branch because RFDs do not allow other devices to associate. Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices. A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators . . ." IEEE Std 802.15.4-2011, at p. 10. "The simplest form of a cluster tree network is a single cluster network, but larger networks are possible by forming a mesh of multiple neighboring clusters. Once predetermined application or network requirements are met, the first PAN coordinator instructs a device to become the PAN coordinator of a new cluster adjacent to the first one. Other devices gradually connect and form a multicluster network structure, such as the one seen in Figure 2. The lines in Figure 2 represent the parent-child relationships of the devices and not the communication flow."

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	IEEE Std 802.15.4-2011, at p. 10. Figure 2—Cluster tree network IEEE Std 802.15.4-2011, at p. 10, Figure 2. "ZigBee router: an IEEE 802.15.4 FFD participating in a ZigBee network, which is not the ZigBee coordinator but may act as an IEEE 802.15.4 coordinator within its personal operating space, that is capable of *routing messages between devices and supporting associations*."

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	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 11. ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 189. "The ZigBee coordinator shall *maintain a list of currently associated devices* and facilitate *support of orphan scan and rejoin processing to enable previously associated devices to rejoin the network*. The ZigBee coordinator may support the ability for devices to be directly included in the network via the NLME-DIRECT-JOIN.request and NLME-DIRECT-JOIN.confirm. This feature shall permit lists of ZigBee IEEE addresses to be provided to the ZigBee coordinator and for those

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	addresses to be included as previously associated devices. It shall be possible for ZigBee devices with those addresses to directly join the network via orphaning or rejoin procedures rather than associating directly" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 193. "The ZigBee router shall *maintain a list of currently associated end devices* and facilitate *support of orphan scan and rejoin processing to enable previously associated end devices to rejoin the network*" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 195.

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	2.5.4.5.4.1 Overview The operations described in this section are carried out by ZigBee Coordinator and ZigBee Router Devices for support of intra-PAN portability. The main steps are summarized as follows: • Detect the problem - The ZDO of the moved device is notified of acknowledgement failures via the NLME-NWK-STATUS.indication primitive, and identifies a problem. • Carry out the NWK layer rejoin procedure - The ZDO of a moved ZED initiates this process using the NLME-JOIN.request primitive, either through a secured or un-secured rejoining procedure. The NWK rejoin procedures closely mirror the MAC association procedure. Note that ZigBee Routers shall also carry out this procedure periodically if they find that they are no longer in contact with the Trust Center. • Security verification - Secured and unsecured protocol steps are described to ensure that the orphaned device should really be accepted. • Inform the rest of the network - when a device changes parents the steps to complete address conflict detection in section 3.6.1.9 must be completed. These actions also serve to notify the old parent that the End Device has changed parents. • Provide a means for parents that were temporarily unavailable and caused the end-device to rejoin are able to update their child tables once they are back online. ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 196 "This verification is carried out using existing commands. Section 2.5.4.5.4.3 below describes the transmission of a Device_annce command to the new parent. The new parent shall check that this or some other message is correctly formed and contains the addressing fields corresponding to the orphaned device. If security is enabled, then this command shall be secured with the network key, and the new parent shall verify that all security processing is carried out correctly. If all these checks succeed then the orphaned device shall become joined to the network. Otherwise, it shall not become joined to the network at this time. As normal, messages sent from a device not joined to the network shall not be forwarded across the network, and commands shall not be carried out.

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	Accordingly, the orphaned device shall only become joined to the network once it receives at least one correctly formed ZigBee message from the new parent." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 199. "This text describes the security operations for support of rejoining which are to be carried out by the ZigBee coordinator and by ZigBee routers that are already operating on the network. These devices will receive rejoin requests by orphaned devices and will act as follows. Following the steps described in section 2.5.4.5.2.2, an orphaned device (router or end device) shall be provisionally accepted onto the network by the coordinator or router for at least *apsSecurityTimeOutPeriod* milliseconds. During this period it shall be required to send at least one correctly formed ZigBee message secured with the network key to the new parent. If this message successfully passes all the security processing steps described in this document, it shall be accepted as a member of the network" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 435. "The procedure for a ZigBee coordinator or router to rejoin a device to its network using the NWK rejoin procedure is initiated by the arrival of a NWK layer rejoin command frame via the MAC data service. Only those devices that are either ZigBee coordinators or ZigBee routers shall initiate this procedure. If this procedure is initiated on any other device, the NLME shall terminate the procedure. When this procedure is initiated, the NLME of a potential parent shall first determine whether it already has knowledge of the re-questing device. To do this, the NLME shall search its neighbor table in order to determine whether a matching 64-bit, extended address can be found." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 315. "A device is notified of the presence of an orphaned device when it receives the MLME-ORPHAN.indication primitive from the MAC sub-layer. Only devices that are either ZigBee

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	coordinators or ZigBee routers (that is, devices with parental capabilities) shall initiate this procedure. If this procedure is initiated by any other device, the NLME shall terminate the procedure.

When this procedure is initiated, the NLME shall first determine whether the orphaned device is its child. This is accomplished by comparing the extended address of the orphaned device with the addresses of its children, as recorded in its neighbor table."

ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 318.

"The neighbor table of a device shall contain information on every device within transmission range, up to some implementation-dependent limit.

The neighbor table is useful in two contexts. First of all, it is used during network discovery or rejoining to store information about routers within RF reception range that may be candidate parents. Second, after the device has joined a network, it is used to store relationship and link-state information about neighboring devices in that network. A table entry shall be updated every time a device receives any frame from the corresponding neighbor."

ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 319.

"If a coordinator receives the orphan notification command, the MLME shall send the MLME.ORPHAN.indication primitive, as described in 6.2.7.1, to the next higher layer. The next higher layer should then search its device list for the device indicated by the primitive. If the next higher layer finds a record of the device, it should send a coordinator realignment command to the orphaned device using the MLME.ORPHAN.response primitive, as described in 6.2.7.2 . . ."
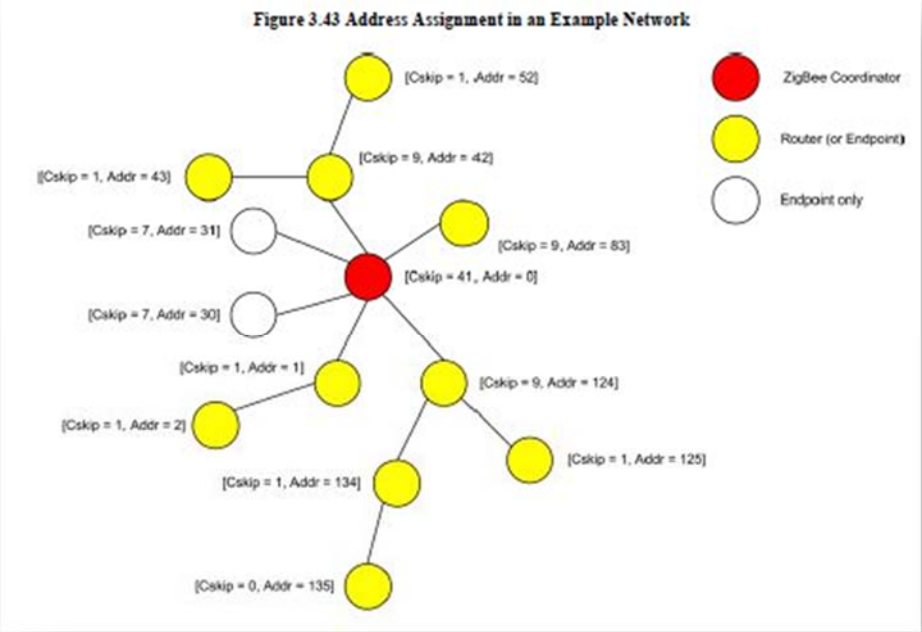
IEEE Std 802.15.4-2011, at p. 27. |

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	"If the next higher layer receives repeated communications failures following its requests to transmit data, it may conclude that it has been orphaned. . . . If the next higher layer concludes that it has been orphaned, it may instruct the MLME to either perform the orphaned device realignment procedure or reset the MAC sublayer and then perform the association procedure" IEEE Std 802.15.4-2011, at p. 39. "The startup procedure outlined in section 2.5.4.5.6.2 is designed in such a way that, by using it consistently, devices can go through all the stages of commissioning up to being joined to the proper ZigBee network and able to send and receive application data traffic. Later-stage commissioning, including the commissioning of bindings and group membership is discussed briefly in section 2.5.4.5.6.3" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 202. "Once a device is on a network and capable of communicating with other devices on the network in a secure manner, other commissioning becomes possible. Other items that should be subject to commissioning are shown in Table 2.144" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 203. "The responsibilities of the ZigBee NWK layer shall include mechanisms used to join and leave a network, to apply security to frames and to route frames to their intended destinations. In addition, the discovery and maintenance of routes between devices devolve to the NWK layer. Also the discovery of one-hop neighbors and the storing of pertinent neighbor information are done at the NWK layer. The NWK layer of a ZigBee coordinator (see 'Network topology') is responsible for starting a new network, when appropriate, and assigning addresses to newly associated devices" ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 17-18.

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	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 325, Figure 3.43; *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 224, Figure 54.

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[g] a designation module to designate said communication unit as said routing unit in response to determining that said communication unit communicates with at least one neighboring unit that is isolated from communications with remaining neighboring units of said communication unit, wherein said communication unit designation as said routing unit is fixed for routing subsequent network messages; and	The Huawei '537 Patent Accused Products incorporate configuration modules including designation modules that designate the communication unit as a routing unit in response to determining that the communication unit communicates with at least one neighboring unit that is isolated from communications with remaining neighboring units of the communication unit. For example, and without limitation:
	
	See claim element 1[f] above.
	
	The Huawei '537 Patent Accused Products also incorporate configuration modules including designation modules that determine a status of that communication unit as a routing unit, wherein that status as a routing unit is fixed for routing subsequent network messages. For example, and without limitation:
	
	Zigbee and IEEE 802.15.4 standards describe and require that one device be fixed as an overall PAN controller, while other devices can be fixed as coordinators. Once established, the device status persists until, for example, there is a change in network connectivity.
	
	    "An example of the use of the peer-to-peer communications topology is the cluster tree. The cluster tree network is a special case of a peer-to-peer network in which most devices are FFDs. An RFD connects to a cluster tree network as a leaf device at the end of a branch because RFDs do not allow other devices to associate. Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices."
	
	IEEE Std 802.15.4-2011, at p. 10.
	
	    "The simplest form of a cluster tree network is a single cluster network, but larger networks are possible by forming a mesh of multiple neighboring clusters. Once predetermined application or

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	network requirements are met, the first PAN coordinator instructs a device to become the PAN coordinator of a new cluster adjacent to the first one" IEEE Std 802.15.4-2011, at p. 10. "5.1.2.5 Device discovery The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery. A coordinator that is not the PAN coordinator shall begin transmitting beacon frames only when it has successfully associated with a PAN. The transmission of beacon frames by the device is initiated through the use of the MLME-START.request primitive with the PANCoordinator parameter set to FALSE." IEEE Std 802.15.4-2011, at p. 32. "A coordinator shall allow association only if *macAssociationPermit* is set to TRUE. Similarly, a device should attempt to associate only with a PAN through a coordinator that is currently allowing association, as indicated in the results of the scanning procedure. If a coordinator with *macAssociationPermit* set to FALSE receives an association request command from a device, the command shall be ignored. A device that is instructed to associate with a PAN, through the MLME-ASSOCIATE.request primitive, shall try to associate only with an existing PAN and shall not attempt to start its own PAN. The MAC sublayer of an unassociated device shall initiate the association procedure by sending an association request command, as described in 5.3.1, to the coordinator of an existing PAN; if the

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	association request command cannot be sent due to a channel access failure, the MAC sublayer shall notify the next higher layer."
	IEEE Std 802.15.4-2011, at p. 33.
	"When a coordinator wants one of its associated devices to leave the PAN, the MLME of the coordinator shall send the disassociation notification command in the manner specified by the TxIndirect parameter of the MLME-DISASSOCIATE.request primitive previously sent by the next higher layer."
	IEEE Std 802.15.4-2011, at p. 34
	"If the direct or indirect transmission fails, the coordinator should consider the device disassociated.
	If an associated device wants to leave the PAN, the MLME of the device shall send a disassociation notification command to its coordinator. If the disassociation notification command cannot be sent due to a channel access failure, the MAC sublayer shall notify the next higher layer. If the acknowledgment to disassociation request is not received, the device should consider itself disassociated."
	IEEE Std 802.15.4-2011, at p. 36.
	"If a device misses between one and (*aMaxLostBeacons*–1) consecutive beacon frames from its coordinator, the device shall continue to transmit its own beacons based on both *macBeaconOrder*, as defined in 5.1.2.3.4, and its local clock. If the device then receives a beacon frame from its coordinator and, therefore, does not lose synchronization, the device shall resume transmitting its own beacons based on the StartTime parameter and the incoming beacon."

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	IEEE Std 802.15.4-2011, at p. 32. IEEE Std 802.15.4-2011, at p. 125, Table 51. "The responsibilities of the ZDO include ***defining the role of the device within the network (e.g., ZigBee coordinator or end device)***, initiating and/or responding to binding requests and establishing a secure relationship between network devices. The ZDO is also responsible for discovering devices on the network and determining which application services they provide." ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 18. "A parent-child relationship is formed when a device having membership in the network allows a new device to join. The new device becomes the child, while the first device becomes the parent. A child can be added to a network in the following two ways: the child can join the network using the MAC layer association procedure or the child can be added to the network directly by a previously designated parent device." ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 212. "a parent-child relationship is formed when a device having membership in the network allows a new device to join. On joining, the new device becomes the child, while the first device becomes the parent."

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	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 306. ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 325, Figure 3.43.

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[h] a monitor module to re-evaluate said communication unit designation in response to connectivity changes in said network.	The Huawei '537 Patent Accused Products incorporate configuration modules including monitor modules that re-evaluate the communication unit designation in response to connectivity changes in the network. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that one device be fixed as an overall PAN controller, and that this status be re-evaluated via a contention resolution mechanism when changes in network connectivity result in multiple devices attempting to establish themselves as PAN coordinators. Other devices can be fixed as coordinators. Once established, the device status persists until, for example, there is a change in network connectivity. "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices. ***A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators . . .***" IEEE Std 802.15.4-2011, at p. 10. "**personal area network (PAN) coordinator**: A coordinator that is the principal controller of a PAN. An IEEE 802.15.4 network has exactly one PAN coordinator." IEEE Std 802.15.4-2011, at p. 5. "In some instances a situation could occur in which two PANs exist in the same radio communications range with the same PAN identifier. If this conflict happens, the PAN coordinator and its devices shall perform the PAN identifier conflict resolution procedure."

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	IEEE Std 802.15.4-2011, at p. 27. "On the detection of a PAN identifier conflict by the PAN coordinator, the MLME shall issue an MLMESYNC-LOSS.indication to the next higher layer with the LossReason parameter set to PAN_ID_CONFLICT. The next higher layer of the PAN coordinator may then perform an active scan and, using the information from the scan, select a new PAN identifier. The algorithm for selecting a suitable PAN identifier is outside the scope of this standard. If the next higher layer does select a new PAN identifier, it may then issue an MLME-START.request with the CoordRealignment parameter set to TRUE in order to realign the PAN, as described in 5.1.2.3" IEEE Std 802.15.4-2011, at p. 29. "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices." IEEE Std 802.15.4-2011, at p. 10. "5.1.2.5 Device discovery The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery. A coordinator that is not the PAN coordinator shall begin transmitting beacon frames only when it has successfully associated with a PAN. The transmission of beacon frames by the device is initiated through the use of the MLME-START.request primitive with the PANCoordinator parameter set to FALSE."

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	IEEE Std 802.15.4-2011, at p. 32. "A coordinator shall allow association only if *macAssociationPermit* is set to TRUE. Similarly, a device should attempt to associate only with a PAN through a coordinator that is currently allowing association, as indicated in the results of the scanning procedure. If a coordinator with *macAssociationPermit* set to FALSE receives an association request command from a device, the command shall be ignored. A device that is instructed to associate with a PAN, through the MLME-ASSOCIATE.request primitive, shall try to associate only with an existing PAN and shall not attempt to start its own PAN. The MAC sublayer of an unassociated device shall initiate the association procedure by sending an association request command, as described in 5.3.1, to the coordinator of an existing PAN; if the association request command cannot be sent due to a channel access failure, the MAC sublayer shall notify the next higher layer." IEEE Std 802.15.4-2011, at p. 33. "When a coordinator wants one of its associated devices to leave the PAN, the MLME of the coordinator shall send the disassociation notification command in the manner specified by the TxIndirect parameter of the MLME-DISASSOCIATE.request primitive previously sent by the next higher layer" IEEE Std 802.15.4-2011, at p. 34. "If the direct or indirect transmission fails, the coordinator should consider the device disassociated.

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	If an associated device wants to leave the PAN, the MLME of the device shall send a disassociation notification command to its coordinator. If the disassociation notification command cannot be sent due to a channel access failure, the MAC sublayer shall notify the next higher layer. If the acknowledgment to disassociation request is not received, the device should consider itself disassociated" IEEE Std 802.15.4-2011, at p. 36. "If a device misses between one and (*aMaxLostBeacons*–1) consecutive beacon frames from its coordinator, the device shall continue to transmit its own beacons based on both *macBeaconOrder*, as defined in 5.1.2.3.4, and its local clock. If the device then receives a beacon frame from its coordinator and, therefore, does not lose synchronization, the device shall resume transmitting its own beacons based on the StartTime parameter and the incoming beacon." IEEE Std 802.15.4-2011, at p. 32. IEEE Std 802.15.4-2011, at p. 125, Table 51. "The Parent_annce is provided to enable ZigBee routers (including the coordinator) on the network to notify other ZigBee routers about all the end devices known to the local device. This command provides a means to resolve conflicts more quickly than aging out the child, when multiple routers purport to be the active parent of a particular end-device. The command may be broadcast from

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	one router to all routers and the coordinator using the broadcast address 0xFFFC or unicast from one router to another router. This message must be generated if all the following conditions are met: 1. *The router or coordinator device has rebooted*. 2. The router or coordinator is operating in the joined and authenticated state." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 94. "After processing all entries in the neighbor table, if the NumberOfChildren is greater than 0, then it shall send the message to the all routers broadcast address (0xFFFC)." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 95. "If the device type is a ZigBee Router or ZigBee End Device, this function shall provide the ability to select an existing PAN to join and implement orphaning procedures which permit the device to re-associate with the same ZigBee Coordinator or ZigBee Router if network communication is lost. If the device type is a ZigBee Coordinator or ZigBee Router, this function shall provide the ability to select an unused channel for creation of a new PAN. Note that is possible to deploy a network without a device pre-designated as ZigBee Coordinator where the first Full Function Device (FFD) activated device assumes the role of ZigBee Coordinator." ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 135.

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ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 189.

"The ZigBee coordinator shall respond to any device discovery or service discovery operations requested of its own device or any of its sleeping associated devices using the attributes described in Sections 5.4 of this document."

ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 141 |

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'537 PATENT CLAIM 1	INFRINGEMENT BY HUAWEI CORPORATION
	"The ZigBee coordinator shall maintain a list of currently associated devices and facilitate support of orphan scan processing to enable previously associated devices to rejoin the network." ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 142. "**Disassociation**: the service provided by the IEEE 802.15.4-2003 MAC sub-layer that is used to discontinue the membership of a device in a network." ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 21.

'537 PATENT CLAIM 2	INFRINGEMENT BY HUAWEI CORPORATION
2. The unit of claim 1 wherein said transmitter transmits said outgoing message in the form of radio signals.	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate RF transmitters (see Claim 1 above) that transmit outgoing messages in the form of radio signals. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require transmission at certain frequency ranges in the radio spectrum: "The PHY layer operates in two separate frequency ranges: 868/915 MHz and 2.4 GHz. The lower frequency PHY layer covers both the 868 MHz European band and the 915 MHz band, used in countries such as the United States and Australia. The higher frequency PHY layer is used virtually worldwide." ZigBee Specification, Version r21 (Aug. 5, 2015), at 1.

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'537 PATENT CLAIM 2	INFRINGEMENT BY HUAWEI CORPORATION
	"Physical layers (PHYs) are defined for — Devices operating in the license-free 868–868.6 MHz, 902–928 MHz, and 2400–2483.5 MHz bands" IEEE Std 802.15.4-2011, at p. 1. "In a peer-to-peer topology, each device is capable of communicating with any other device within its radio communications range" IEEE Std 802.15.4-2011, at p. 9. "An LR-WPAN device comprises at least one PHY, which contains the *radio frequency (RF) transceiver* along with its low-level control mechanism, and a MAC sublayer that provides access to the physical channel for all types of transfer." IEEE Std 802.15.4-2011, at p. 11.

'537 PATENT CLAIM 3	INFRINGEMENT BY HUAWEI CORPORATION
3. The unit of claim 1 wherein said receiver receives said incoming message in the form of radio signals.	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate RF receivers (see Claim 1 above) that receive incoming messages in the form of radio signals. *See* Claim 2 above.

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'537 PATENT CLAIM 4	INFRINGEMENT BY HUAWEI CORPORATION
4. The unit of claim 1 wherein said processor further includes:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 1 above.
[a] a status transmission module to facilitate transmission of a unit status message at a periodic time interval, wherein said unit status message includes unit connectivity information relating to network connectivity of said communication unit; and	The Huawei '537 Patent Accused Products incorporate status transmission modules that facilitate transmission of a unit status message at a periodic time interval, wherein the unit status message includes unit connectivity information relating to network connectivity of the communication unit. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each LR-WPAN device to include a MAC sublayer, which manages the periodic transmission of beacon messages that communicate unit connectivity information: "An LR-WPAN device comprises at least one PHY, which contains the radio frequency (RF) transceiver along with its low-level control mechanism, and a MAC sublayer that provides access to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11.

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'537 PATENT CLAIM 4	INFRINGEMENT BY HUAWEI CORPORATION
	Figure 3—LR-WPAN device architecture IEEE Std 802.15.4-2011, at p. 11, Figure 3. "The features of the MAC sublayer are ***beacon management***, channel access, GTS management, frame validation, acknowledged frame delivery, association, and disassociation." IEEE Std 802.15.4-2011, at p. 11. "Any FFD is able to act as a coordinator and provide ***synchronization services*** to other devices or other coordinators. . . . A candidate device receiving a beacon frame is able to request to join the network at the PAN coordinator. If the PAN coordinator permits the device to join, it adds the new device as a child device in its neighbor list. Then the newly joined device adds the PAN coordinator as its parent in its neighbor list and ***begins transmitting periodic beacons***; other

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'537 PATENT CLAIM 4	INFRINGEMENT BY HUAWEI CORPORATION
	candidate devices are able to then join the network at that device. . . . The detailed procedures describing how a PAN is started and how devices join a PAN are found in 5.1.2 and 5.1.3." IEEE Std 802.15.4-2011, at p. 10. Figure 2—Cluster tree network IEEE Std 802.15.4-2011, at p. 10, Figure 2.

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'537 PATENT CLAIM 4	INFRINGEMENT BY HUAWEI CORPORATION
	"The mechanisms for each transfer type depend on whether the network supports the transmission of periodic beacons. A beacon-enabled PAN is used in networks that either require synchronization or support for low latency devices, such as PC peripherals. If the network does not need synchronization or support for low latency devices, it can elect not to use the beacon for normal transfers. However, the beacon is still required for network discovery. The structure of the frames used for the data transfer is specified in 5.2." IEEE Std 802.15.4-2011, at p. 13. "5.1.2.4 Beacon generation . . . All beacon frames, as defined in 5.2.2.1, shall be transmitted at the beginning of each superframe at an interval equal to $aBase\text{-}SuperframeDuration \times 2^n$, where n is the value of $macBeaconOrder$" IEEE Std 802.15.4-2011, at p. 31-32. "5.1.2.5 Device discovery The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery. . . . A beacon frame shall be transmitted at a rate of one beacon frame every $aBaseSuperframeDuration \times 2^n$, where n is the value of $macBeaconOrder$" IEEE Std 802.15.4-2011, at p. 32. Zigbee and IEEE 802.15.4 standards also describe and require the periodic transmission of link status commands that communicate status information:

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'537 PATENT CLAIM 4	INFRINGEMENT BY HUAWEI CORPORATION
	"To accomplish this, routers exchange link cost measurements with their neighbors by periodically transmitting link status frames as a one-hop broadcast. The reverse link cost information is then used during route discovery to ensure that discovered routes use high-quality links in both directions." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 344. "When joined to a network, a ZigBee router or coordinator shall ***periodically send a link status command every nwkLinkStatusPeriod seconds***, as a one-hop broadcast without retries. It may be sent more frequently if desired. Random jitter should be added to avoid synchronization with other nodes." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 344. "The link status command frame ***allows neighboring routers to communicate their incoming link costs to each other*** as described in section 3.6.3.4. Link status frames are transmitted as one-hop broadcasts without retries." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 283.
[b] a status reception module to facilitate reception of said unit status message from said each neighboring unit and to update said connectivity information within said storage unit in accordance with unit connectivity information contained within	The Huawei '537 Patent Accused Products incorporate status reception modules that facilitate reception of unit status messages from each neighboring unit and updating connectivity information within the storage unit in accordance with unit connectivity information contained within each received unit status message. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that devices continuously send beacons to their neighboring units with network connectivity information to facilitate update of that information in each device's stored neighbor tables. For example, and without limitation:

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'537 PATENT CLAIM 4	INFRINGEMENT BY HUAWEI CORPORATION
each received unit status message.	"Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. . . . A candidate device receiving a beacon frame is able to request to join the network at the PAN coordinator. If the PAN coordinator permits the device to join, it adds the new device as a child device in its neighbor list. Then the newly joined device adds the PAN coordinator as its parent in its neighbor list and begins transmitting periodic beacons; other candidate devices are able to then join the network at that device. If the original candidate device is not able to join the network at the PAN coordinator, it will search for another parent device. The detailed procedures describing how a PAN is started and how devices join a PAN are found in 5.1.2 and 5.1.3." IEEE Std 802.15.4-2011, at p. 10. "A beacon-enabled PAN is used in networks that either require synchronization or support for low latency devices, such as PC peripherals. If the network does not need synchronization or support for low latency devices, it can elect not to use the beacon for normal transfers. However, the beacon is still required for network discovery. The structure of the frames used for the data transfer is specified in 5.2." IEEE Std 802.15.4-2011, at p. 13. "Otherwise, ***the device shall copy the relevant information from each received beacon (see Figure 3.51 for the structure of the beacon payload) into its neighbor table*** (see Table 3.53 for the contents of a neighbor table entry)." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 306. "The neighbor table of a device shall contain information on every device within transmission range, up to some implementation-dependent limit.

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'537 PATENT CLAIM 4	INFRINGEMENT BY HUAWEI CORPORATION
	The neighbor table is useful in two contexts. First of all, it is used during network discovery or rejoining to store information about routers within RF reception range that may be candidate parents. Second, after the device has joined a network, it is used to store relationship and link-state information about neighboring devices in that network. A table entry shall be updated every time a device receives any frame from the corresponding neighbor."

ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 319. |

'537 PATENT CLAIM 5	INFRINGEMENT BY HUAWEI CORPORATION
5. The unit of claim 4 wherein said processor further includes:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 4 above.
[a] an interval module to adjust said periodic time interval in response to detecting modifications in network connectivity indicated by said updated connectivity information within said storage unit.	The Huawei '537 Patent Accused Products incorporate interval modules that adjust the periodic time interval in response to detecting modifications in network connectivity indicated by updated connectivity information within the storage unit. For example, and without limitation:

Zigbee and IEEE 802.15.4 standards describe and require each LR-WPAN device to include a MAC sublayer, which manages the generation of periodic beacon messages, synchronizing to beacon messages from other nodes, and supporting association and disassociation of nodes from the network. For example, when a loss of connectivity to a neighboring "coordinator" node is detected, a device is instructed to adjust the beacon transmission interval to be based on its own internal settings, rather than the incoming beacons: |

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'537 PATENT CLAIM 5	INFRINGEMENT BY HUAWEI CORPORATION
	"An LR-WPAN device comprises . . . a MAC sublayer that provides access to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11. IEEE Std 802.15.4-2011, at p. 11, Figure 3.

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'537 PATENT CLAIM 5	INFRINGEMENT BY HUAWEI CORPORATION
	5.1 MAC functional description The MAC sublayer handles all access to the physical radio channel and is responsible for the following tasks: — Generating network beacons if the device is a coordinator — Synchronizing to network beacons — Supporting PAN association and disassociation — Supporting device security — Employing the CSMA-CA mechanism for channel access — Handling and maintaining the GTS mechanism — Providing a reliable link between two peer MAC entities IEEE Std 802.15.4-2011, at p. 18. "The structure of this superframe is described by the values of *macBeaconOrder* and *macSuperframeOrder*. The MAC PIB attribute *macBeaconOrder* describes the **interval at which the coordinator shall transmit its beacon frames**. The value of *macBeaconOrder* and the **beacon interval**, BI, are related as follows: $BI = aBaseSuperframeDuration \times 2^{macBeaconOrder}$" IEEE Std 802.15.4-2011, at p. 18. "5.1.2.4 Beacon generation

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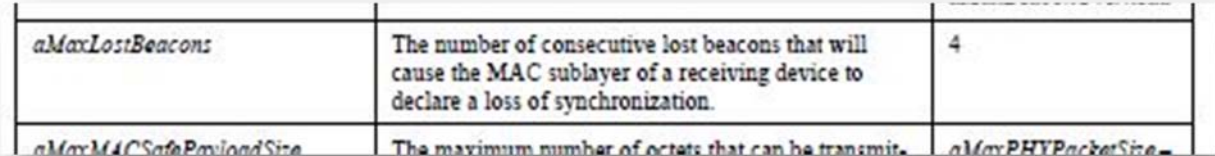| '537 PATENT CLAIM 5	INFRINGEMENT BY HUAWEI CORPORATION
	. . . All beacon frames, as defined in 5.2.2.1, shall be transmitted at the beginning of each superframe ***at an interval*** equal to *aBase-SuperframeDuration* $\times$ 2^n, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 31-32 "5.1.2.5 Device discovery The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery. . . . A beacon frame shall be transmitted at a rate of one beacon frame every *aBaseSuperframeDuration* $\times$ 2^n, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 32. "If a device misses between one and (*aMaxLostBeacons*–1) consecutive beacon frames from its coordinator, the device shall continue to transmit its own beacons based on both *macBeaconOrder*, as defined in 5.1.2.3.4, and its local clock. If the device then receives a beacon frame from its coordinator and, therefore, does not lose synchronization, the device shall resume transmitting its own beacons based on the StartTime parameter and the incoming beacon." IEEE Std 802.15.4-2011, at p. 32.

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'537 PATENT CLAIM 5	INFRINGEMENT BY HUAWEI CORPORATION
	IEEE Std 802.15.4-2011, at p. 125, Table 51. Zigbee and IEEE 802.15.4 standards also describe adjustment of the periodic transmission interval of link status commands that communicate status information: "***When joined to a network***, a ZigBee router or coordinator shall periodically send a link status command every *nwkLinkStatusPeriod* seconds, as a one-hop broadcast without retries. It ***may be sent more frequently if desired***. Random jitter should be added to avoid synchronization with other nodes." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 344

'537 PATENT CLAIM 10	INFRINGEMENT BY HUAWEI CORPORATION
10. The unit of claim 1 wherein said configuration module further includes:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 1 above.

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'537 PATENT CLAIM 10	INFRINGEMENT BY HUAWEI CORPORATION
[a] a link storage unit to store connectivity information relating to routing units; and	The Huawei '537 Patent Accused Products incorporate link storage units to store connectivity information relating to routing units. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that network connectivity information be stored within a link storage unit. For example, and without limitation: "The neighbor table of a device shall contain information on every device within transmission range, up to some implementation-dependent limit. The neighbor table is useful in two contexts. First of all, it is used during network discovery or rejoining to store information about routers within RF reception range that may be candidate parents. Second, after the device has joined a network, it is used to store relationship and link-state information about neighboring devices in that network. A table entry shall be updated every time a device receives any frame from the corresponding neighbor." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 319. "A candidate device receiving a beacon frame is able to request to join the network at the PAN coordinator. If the PAN coordinator permits the device to join, it adds the new device as a child device in its neighbor list. Then the newly joined device adds the PAN coordinator as its parent in its neighbor list and begins transmitting periodic beacons; other candidate devices are able to then join the network at that device. If the original candidate device is not able to join the network at the PAN coordinator, it will search for another parent device." IEEE Std 802.15.4-2011, at p. 10.
[b] a routing unit configuration module to	The Huawei '537 Patent Accused Products incorporate routing unit configuration modules to examine network connectivity information within said link storage unit in response to the communication unit being

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'537 PATENT CLAIM 10	INFRINGEMENT BY HUAWEI CORPORATION
examine said network connectivity information within said link storage unit in response to said communication unit being designated as said routing unit and to designate said communication unit as a transmission routing unit in response to determining that said communication unit communicates with at least one neighboring routing unit that is isolated from communications with remaining neighboring routing units of said communication unit.	designated as a routing unit and to designate the communication unit as a transmission routing unit in response to determining that the communication unit communicates with at least one neighboring routing unit that is isolated from communications with remaining neighboring routing units of the communication unit. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that devices capable of acting as PAN coordinators (e.g. transmission routing units) monitor communications from neighboring units to examine network connectivity information. Upon receiving communications from neighboring units that have become orphaned, a device may become a new parent routing unit for that orphaned neighboring unit. For example, and without limitation: *See* claim elements 1[f] and 1[g] above.

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'537 PATENT CLAIM 11	INFRINGEMENT BY HUAWEI CORPORATION
11. The unit of claim 10 wherein said transmission routing unit transmits update messages including network connectivity information, and said routing unit configuration module further includes:	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate transmission routing units that transmits update messages including network connectivity information. *See* claim element 4[a] above.
[a] a message forwarding module to receive an update message from a neighboring transmission routing unit in response to said communication unit being designated as said transmission routing unit and to transmit said received message to neighboring routing units to facilitate synchronization of said link storage unit of each said routing unit.	The Huawei '537 Patent Accused Products incorporate message forwarding modules that receive an update message from a neighboring transmission routing unit in response to the communication unit being designated as s transmission routing unit and transmit the received message to neighboring routing units to facilitate synchronization of the link storage unit of each routing unit. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that devices continuously update their neighboring units with network connectivity information to facilitate synchronization of that information in each device's stored neighbor tables. For example, and without limitation: "Any FFD is able to act as a coordinator and provide ***synchronization services to other devices or other coordinators***. . . . A candidate device receiving a beacon frame is able to request to join the network at the PAN coordinator. If the PAN coordinator permits the device to join, it adds the new device as a child device in its neighbor list. Then the newly joined device adds the PAN coordinator as its parent in its neighbor list and ***begins transmitting periodic beacons***; other candidate devices are able to then join the network at that device. If the original candidate device is not able to join the network at the PAN coordinator, it will search for another parent device. The detailed procedures describing how a PAN is started and how devices join a PAN are found in 5.1.2 and 5.1.3."

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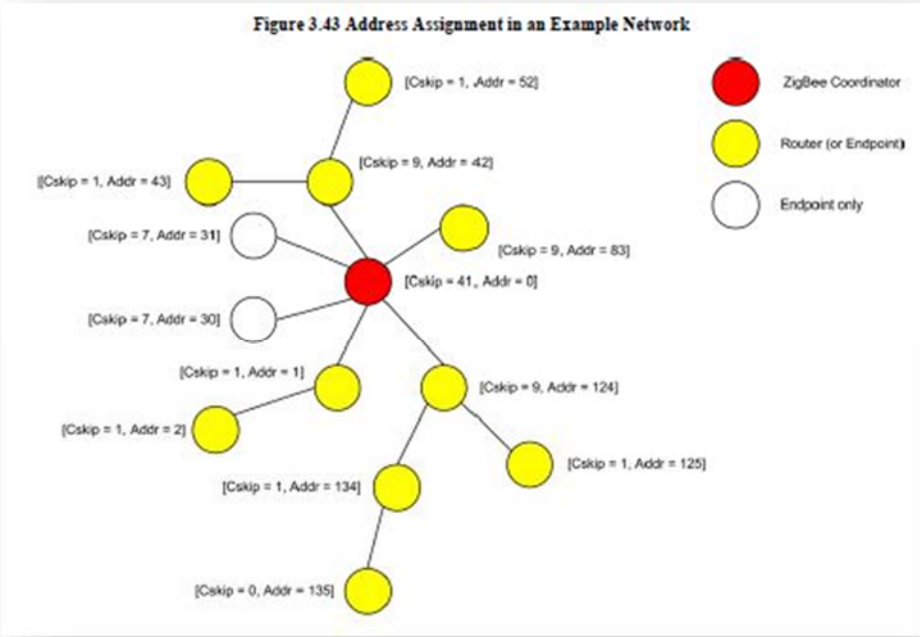| '537 PATENT CLAIM 11	INFRINGEMENT BY HUAWEI CORPORATION
	IEEE Std 802.15.4-2011, at p. 10. "A beacon-enabled PAN is used in networks that either require synchronization or support for low latency devices, such as PC peripherals. If the network does not need synchronization or support for low latency devices, it can elect not to use the beacon for normal transfers. However, the beacon is still required for network discovery. The structure of the frames used for the data transfer is specified in 5.2." IEEE Std 802.15.4-2011, at p. 13. "Otherwise, the device shall copy the relevant information from each received beacon (see Figure 3.51 for the structure of the beacon payload) into its neighbor table (see Table 3.53 for the contents of a neighbor table entry)." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 306. "The neighbor table of a device shall contain information on every device within transmission range, up to some implementation-dependent limit. The neighbor table is useful in two contexts. First of all, it is used during network discovery or rejoining to store information about routers within RF reception range that may be candidate parents. Second, after the device has joined a network, it is used to store relationship and link-state information about neighboring devices in that network. A table entry shall be updated every time a device receives any frame from the corresponding neighbor." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 319.

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'537 PATENT CLAIM 16	INFRINGEMENT BY HUAWEI CORPORATION
16. In a communications network including a plurality of communication units, wherein at least one of those units is designated as a member unit for transmitting and receiving messages and at least one of those units is designated as a routing unit for routing said messages from said member units, a method of configuring a network communication unit to transmit and receive messages within said network comprising the steps of:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 1 above.
[a] examining network connectivity information relating to said communication unit and corresponding neighboring units stored in a storage unit of said communication unit and identifying neighboring units that are isolated from communications with	The Huawei '537 Patent Accused Products incorporate a communication unit including a storage unit to store network connectivity information relating to the communication unit and corresponding neighboring units. The communication unit examines network connectivity information stored in the storage unit of to identify neighboring units that are isolated from communications with remaining neighboring units of the communication unit. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each device to include a neighbor table storing network connectivity information relating to that device and its neighbors. Examination of that table

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'537 PATENT CLAIM 16	INFRINGEMENT BY HUAWEI CORPORATION
remaining neighboring units of said communication unit;	permits the device to identify which neighbors are isolated from other neighbors. For example, and without limitation: "The neighbor table of a device shall contain information on every device within transmission range, up to some implementation-dependent limit. The neighbor table is useful in two contexts. First of all, it is used during network discovery or rejoining to store information about routers within RF reception range that may be candidate parents. Second, after the device has joined a network, it is used to ***store relationship and link-state information about neighboring devices in that network***. A table entry shall be updated every time a device receives any frame from the corresponding neighbor." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 319. "The responsibilities of the ZigBee NWK layer shall include mechanisms used to join and leave a network, to apply security to frames and to route frames to their intended destinations. In addition, the discovery and maintenance of routes between devices devolve to the NWK layer. Also ***the discovery of one-hop neighbors and the storing of pertinent neighbor information*** are done at the NWK layer. The NWK layer of a ZigBee coordinator (see 'Network topology') is responsible for starting a new network, when appropriate, and assigning addresses to newly associated devices" ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 17-18.

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'537 PATENT CLAIM 16	INFRINGEMENT BY HUAWEI CORPORATION
	Figure 3.43 Address Assignment in an Example Network ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 325, Figure 3.43; *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 224, Figure 54 *See* claim elements 1[c] and 1[f] above.
[b] designating said communication unit as said routing unit in response to	*See* claim element 1[g] above.

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'537 PATENT CLAIM 16	INFRINGEMENT BY HUAWEI CORPORATION
determining that said communication unit communicates with at least one neighboring unit that is isolated from communications with remaining neighboring units of said communication unit, wherein said communication unit designation as said routing unit is fixed for routing subsequent network messages; and	
[c] re-evaluating said communication unit designation in response to connectivity changes in said network.	*See* claim element 1[h] above.

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'537 PATENT CLAIM 17	INFRINGEMENT BY HUAWEI CORPORATION
17. The method of claim 16 wherein said messages are transmitted in the form of radio signals.	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 2 above.

'537 PATENT CLAIM 18	INFRINGEMENT BY HUAWEI CORPORATION
18. The method of claim 16 wherein step (a) further includes:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 16 above.
[a] (a.1) transmitting a unit status message at a periodic time interval, wherein said unit status message includes unit connectivity information relating to network connectivity of said communication unit; and	*See* claim element 4[a] above.

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'537 PATENT CLAIM 18	INFRINGEMENT BY HUAWEI CORPORATION
[b] (a.2) receiving said unit status message from said each neighboring unit and updating said connectivity information within said storage unit in accordance with unit connectivity information contained within each received unit status message.	*See* claim element 4[b] above.

'537 PATENT CLAIM 19	INFRINGEMENT BY HUAWEI CORPORATION
19. The method of claim 18 wherein step (a) further includes:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 18 above.
[a] (a.3) adjusting said periodic time interval in response to detecting modifications in network connectivity indicated by said updated connectivity information within said storage unit.	*See* claim element 5[a] above.

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'537 PATENT CLAIM 24	INFRINGEMENT BY HUAWEI CORPORATION
24. The method of claim 16 further including:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 16 above.
[a] (d) examining network connectivity information relating to routing units stored within a link storage unit of said communication unit in response to said communication unit being designated as said routing unit; and	*See* claim elements 10[a] and 10[b] above.
[b] (e) designating said communication unit as a transmission routing unit in response to determining that said communication unit communicates with at least one neighboring routing unit that is isolated from communications with remaining neighboring routing units of said communication unit.	*See* claim element 10[b] above.

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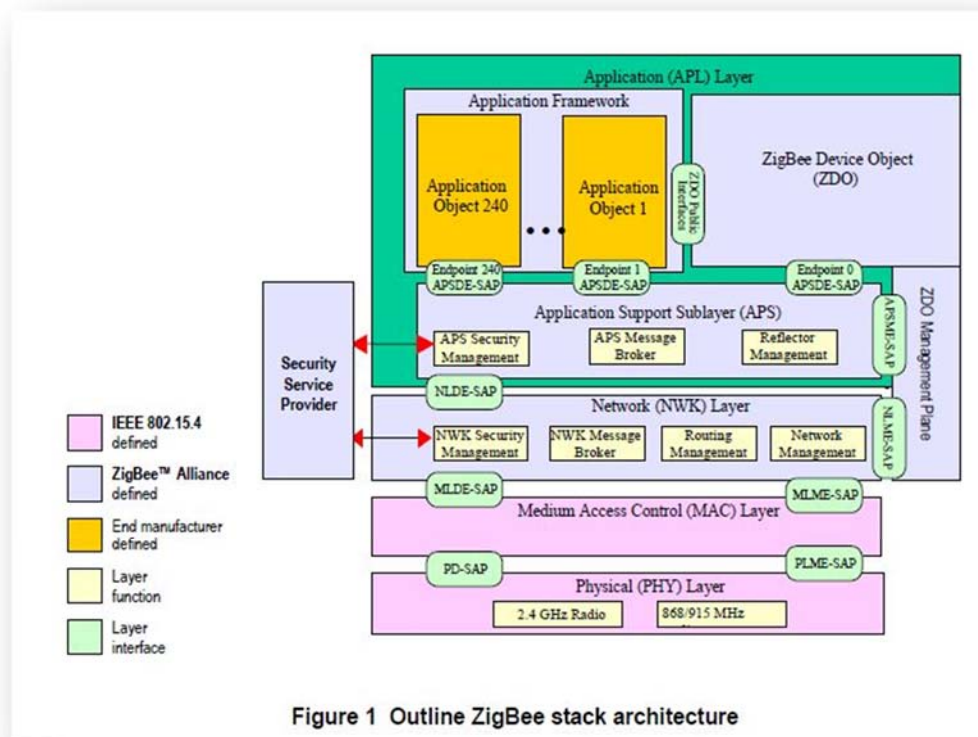| '537 PATENT CLAIM 25	INFRINGEMENT BY HUAWEI CORPORATION
25. The method of claim 24 wherein said transmission routing unit transmits update messages including network connectivity information, and step (e) further includes:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 24 above. *See* Claim 11 above.
[a] (e.1) receiving an update message from a neighboring transmission routing unit in response to said communication unit being designated as said transmission routing unit and transmitting said received message to neighboring routing units to facilitate synchronization of said link storage unit of each said routing unit.	*See* claim element 11[a] above.

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
30. A communications network comprising:	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate a communications network. For example, and without limitation: Huawei is a "Promoter" level member of the Zigbee Alliance and produces products certified by Zigbee. *See, e.g.*, Zigbee Alliance, Our Members, *available at* https://www.zigbee.org/zigbeealliance/our-members/ (last accessed March 27, 2019); Zigbee Alliance, Zigbee Certified Products, *available at* https://www.zigbee.org/zigbee-products-2/#zigbeecertifiedproducts/?view_30_search=Huawei&view_30_page=1 (last accessed March 27, 2019) The Huawei '537 Patent Accused Products comply with the Zigbee standards, including the IEEE 802.15.4 standard (defining the Medium Access Control (MAC) and Physical (PHY) sublayers for Low-Rate Wireless Personal Area Networks (LR-WPANs) connectivity), which is the basis for the MAC and PHY layers in Zigbee certified products. *See, e.g.*, Zigbee Alliance, Zigbee 3.0, *available at* https://www.zigbee.org/zigbee-for-developers/zigbee-3-0/ (last accessed March 27, 2019); *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 17-18; ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 1 ("The IEEE 802.15.4 standard defines the two lower layers: the physical (PHY) layer and the medium access control (MAC) sub-layer. The ZigBee Alliance builds on this foundation by providing the network (NWK) layer and the framework for the application layer.").

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	Figure 1 Outline ZigBee stack architecture ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at p. 18, Figure 1. Huawei represents that certain of its products comply with and communicate according to the Zigbee standards. For example:

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	This topic introduces the wireless network access indicators of the ONT. Table 9-1 Zigbee/Z-Wave access indicators Echolife ONT, Port Specifications, Jan. 24, 2019, at 10. "The AR502 series IoT gateway is designed for industrial environments and supports communication in harsh environments such as extreme temperature, high humidity, and electromagnetic interference. The built-in industrial-grade LTE module supports high bandwidth, low-latency wireless access, and various local interfaces (RS485/RS422, RS232, Gigabit Ethernet and ZigBee) for connecting serial interface devices, Ethernet devices. The AR502 applies to multiple IoT fields, such as smart grid and smart transportation." Huawei AR502 Series IoT Gateway, Datasheet, at 2; *see also* Huawei AP7060DN Access Point Datasheet, *available at* https://e.huawei.com/us/related-page/products/enterprise-network/wlan/indoor-access-points/ap7060dn/wlan-ap7060dn (last accessed March 28, 2019), at 3; Huawei AR160-M Series Enterprise Routers Data Sheet, *available at* https://e.huawei.com/it/related-page/products/enterprise-network/routers/ar-agile/ar160-m/router_ar160-m, at 2.

Indicator	Value(ZigBee)	Value(Z-Wave)
Standards compliance	IEEE 802.15.4 For ZHA1.2 and ZLL1.0 device management	ITU-T G.9959 For device plus management
Communication frequency	2.4GHz	• Australian standard: 908.4-916 MHz • U.S. standard: 919.8-921.42 MHz

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	Zigbee and IEEE 802.15.4 standards describe and require a wireless communication network comprising a number of mobile nodes. IEEE Standard for Local and Metropolitan Area Networks – Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs), IEEE Computer Society, IEEE Std 802.15.4-2011, at p. 9, Figure 1. "A system conforming to this standard consists of several components. The most basic is the device. Two or more devices communicating on the same physical channel constitute a WPAN." IEEE Std 802.15.4-2011, at p. 8

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
[a] a plurality of communication units to transmit and receive messages within said network, wherein each said communication unit includes:	The Huawei '537 Patent Accused Products incorporate communication units to transmit and receive messages within the communications network. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require a wireless communication network comprising a number of mobile nodes. IEEE Standard for Local and Metropolitan Area Networks – Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs), IEEE Computer Society, IEEE Std 802.15.4-2011, at p. 9, Figure 1. "A system conforming to this standard consists of several components. The most basic is the device. ***Two or more devices communicating on the same physical channel constitute a WPAN.***" IEEE Std 802.15.4-2011, at p. 8.

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	"In a peer-to-peer topology, *each device is capable of communicating with any other device within its radio communications range*. One device is nominated as the PAN coordinator, for instance, by virtue of being the first device to communicate on the channel." IEEE Std 802.15.4-2011, at p. 9. "An LR-WPAN device comprises at least one PHY, which contains the radio frequency (RF) transceiver along with its low-level control mechanism, and a MAC sublayer that provides access to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11. "The PHY data service enables the transmission and reception of PHY protocol data units (PPDUs) across the physical radio channel. The general PHY requirements are described in Clause 8. The features of the PHY are activation and deactivation of the radio transceiver, ED, LQI, channel selection, clear channel assessment (CCA), and *transmitting as well as receiving packets across the physical medium*." IEEE Std 802.15.4-2011, at p. 11.
[b] a status transmission module to facilitate periodic transmission of a unit status message;	The Huawei '537 Patent Accused Products incorporate communication units including status transmission modules that facilitate periodic transmission of unit status messages. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each LR-WPAN device to include a MAC sublayer, which manages the periodic transmission of beacon messages that communicate status information:

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	"An LR-WPAN device comprises at least one PHY, which contains the radio frequency (RF) transceiver along with its low-level control mechanism, and a MAC sublayer that provides access to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11. IEEE Std 802.15.4-2011, at p. 11, Figure 3 "The features of the MAC sublayer are ***beacon management***, channel access, GTS management, frame validation, acknowledged frame delivery, association, and disassociation." IEEE Std 802.15.4-2011, at p. 11. "Any FFD is able to act as a coordinator and provide ***synchronization services*** to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices. . . . A candidate device receiving a beacon frame is able to request to join the network at the PAN coordinator. If the PAN coordinator permits the device to join, it adds the new device as a child device in its neighbor list. Then the newly joined device adds the PAN coordinator as its parent in its neighbor list and ***begins transmitting periodic beacons***; other candidate devices are able to then join the network at that device. . . . The detailed procedures describing how a PAN is started and how devices join a PAN are found in 5.1.2 and 5.1.3." IEEE Std 802.15.4-2011, at p. 10.

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	Figure 2—Cluster tree network

IEEE Std 802.15.4-2011, at p. 10, Figure 2

"The mechanisms for each transfer type depend on whether the network supports the transmission of periodic beacons. A beacon-enabled PAN is used in networks that either require synchronization or support for low latency devices, such as PC peripherals. If the network does not need synchronization or support for low latency devices, it can elect not to use the beacon for

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	normal transfers. However, the beacon is still required for network discovery. The structure of the frames used for the data transfer is specified in 5.2." IEEE Std 802.15.4-2011, at p. 13. "5.1.2.4 Beacon generation . . . All beacon frames, as defined in 5.2.2.1, shall be transmitted at the beginning of each superframe at an interval equal to *aBase-SuperframeDuration* $\times 2^n$, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 31-32. "5.1.2.5 Device discovery The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery. . . . A beacon frame shall be transmitted at a rate of one beacon frame every *aBaseSuperframeDuration* $\times 2^n$, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 32. Zigbee and IEEE 802.15.4 standards also describe and require the periodic transmission of link status commands that communicate status information: "To accomplish this, routers exchange link cost measurements with their neighbors by periodically transmitting link status frames as a one-hop broadcast. The reverse link cost information is then

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	used during route discovery to ensure that discovered routes use high-quality links in both directions." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 344. "When joined to a network, a ZigBee router or coordinator shall *periodically send a link status command every nwkLinkStatusPeriod seconds*, as a one-hop broadcast without retries. It may be sent more frequently if desired. Random jitter should be added to avoid synchronization with other nodes." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 344. "The link status command frame *allows neighboring routers to communicate their incoming link costs to each other* as described in section 3.6.3.4. Link status frames are transmitted as one-hop broadcasts without retries." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 283.
[c] an interval module to adjust the time between each said periodic transmission in response to detecting modifications in connectivity with neighboring units; and	The Huawei '537 Patent Accused Products incorporate communication units including interval modules that adjust the time between each said periodic transmission in response to detecting modifications in connectivity with neighboring units. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each LR-WPAN device to include a MAC sublayer, which manages the generation of periodic beacon messages, synchronizing to beacon messages from other nodes, and supporting association and disassociation of nodes from the network. For example, when a loss of connectivity to a neighboring "coordinator" node is detected, a device is instructed to adjust the beacon transmission interval to be based on its own internal settings, rather than the incoming beacons:

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	"An LR-WPAN device comprises . . . a MAC sublayer that provides access to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11. IEEE Std 802.15.4-2011, at p. 11, Figure 3.

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	5.1 MAC functional description The MAC sublayer handles all access to the physical radio channel and is responsible for the following tasks: — Generating network beacons if the device is a coordinator — Synchronizing to network beacons — Supporting PAN association and disassociation — Supporting device security — Employing the CSMA-CA mechanism for channel access — Handling and maintaining the GTS mechanism — Providing a reliable link between two peer MAC entities IEEE Std 802.15.4-2011, at p. 18 "The structure of this superframe is described by the values of *macBeaconOrder* and *macSuperframeOrder*. The MAC PIB attribute *macBeaconOrder* describes the ***interval at which the coordinator shall transmit its beacon frames***. The value of *macBeaconOrder* and the ***beacon interval***, *BI*, are related as follows: $BI = aBaseSuperframeDuration \times 2^{macBeaconOrder}$" IEEE Std 802.15.4-2011, at p. 18. "5.1.2.4 Beacon generation

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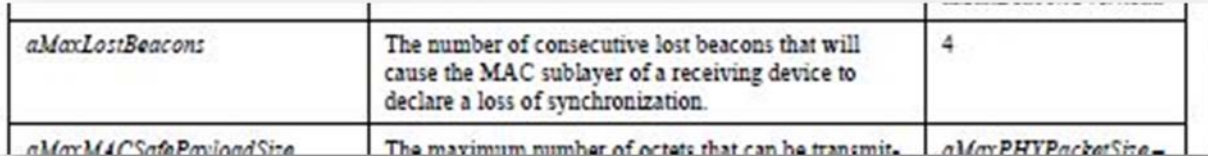
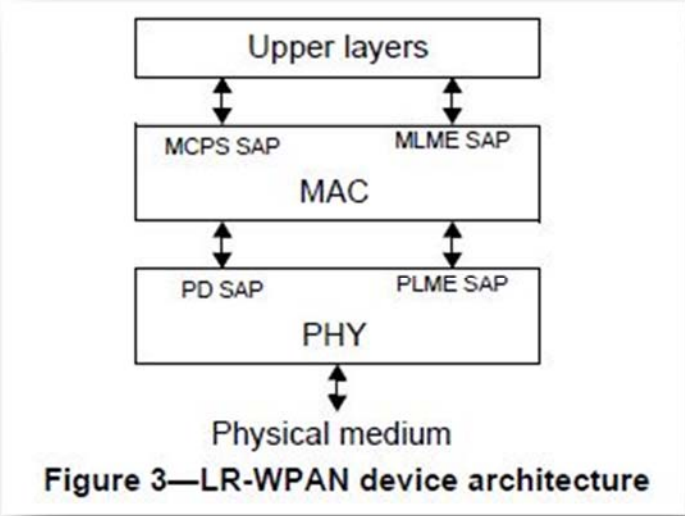| '537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	. . . All beacon frames, as defined in 5.2.2.1, shall be transmitted at the beginning of each superframe *at an interval* equal to *aBase-SuperframeDuration* × 2^n, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 31-32. "5.1.2.5 Device discovery The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery. . . . A beacon frame shall be transmitted at a rate of one beacon frame every *aBaseSuperframeDuration* × 2^n, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 32. "If a device misses between one and (*aMaxLostBeacons*–1) consecutive beacon frames from its coordinator, the device shall continue to transmit its own beacons based on both *macBeaconOrder*, as defined in 5.1.2.3.4, and its local clock. If the device then receives a beacon frame from its coordinator and, therefore, does not lose synchronization, the device shall resume transmitting its own beacons based on the StartTime parameter and the incoming beacon." IEEE Std 802.15.4-2011, at p. 32.

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	  IEEE Std 802.15.4-2011, at p. 125, Table 51 Zigbee and IEEE 802.15.4 standards also describe adjustment of the periodic transmission interval of link status commands that communicate status information: "***When joined to a network***, a ZigBee router or coordinator shall periodically send a link status command every *nwkLinkStatusPeriod* seconds, as a one-hop broadcast without retries. It ***may be sent more frequently if desired***. Random jitter should be added to avoid synchronization with other nodes." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 344.
[d] a configuration module to determine a status of that communication unit as a routing unit for routing network traffic or as a member unit of a corresponding routing unit in accordance with information contained within received unit	The Huawei '537 Patent Accused Products incorporate communication units including configuration modules that determine a status of that communication unit as a routing unit for routing network traffic or as a member unit of a corresponding routing unit in accordance with information contained within received unit status messages. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each LR-WPAN device to include a MAC sublayer, which manages the association and disassociation of devices with the network. Devices may be a full-function device that may serve as a PAN coordinator or coordinator (e.g., a routing unit) or a reduced-

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
status messages, wherein said communication unit status as said routing unit is fixed for routing subsequent network messages and re-evaluated in response to changes in network connectivity.	function device that may only serve as an end device (e.g., a member unit). The coordinators determine the status of nodes by a procedure utilizing information from beacon messages. "An LR-WPAN device comprises . . . a MAC sublayer that provides access to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11. IEEE Std 802.15.4-2011, at p. 11, Figure 3.

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'537 PATENT CLAIM 30	INFRINGEMENT BY HUAWEI CORPORATION
	5.1 MAC functional description The MAC sublayer handles all access to the physical radio channel and is responsible for the following tasks: — Generating network beacons if the device is a coordinator — Synchronizing to network beacons — Supporting PAN association and disassociation — Supporting device security — Employing the CSMA-CA mechanism for channel access — Handling and maintaining the GTS mechanism — Providing a reliable link between two peer MAC entities IEEE Std 802.15.4-2011, at p. 18. "There are two device types: a full-function device (FFD) and a reduced-function device (RFD). The FFD may operate in three modes serving as *a personal area network (PAN) coordinator, a coordinator,* or a device. An RFD shall only operate as *a device*." IEEE Std 802.15.4-2011, at p. 18. "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. *The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting*

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	beacon frames to neighboring devices. A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators . . ." IEEE Std 802.15.4-2011, at p. 10. "Once predetermined application or network requirements are met, the first PAN coordinator instructs a device to become the PAN coordinator of a new cluster adjacent to the first one. Other devices gradually connect and form a multicluster network structure, such as the one seen in Figure 2. The lines in Figure 2 represent the parent-child relationships of the devices and not the communication flow." IEEE Std 802.15.4-2011, at p. 10. "Otherwise, the device shall copy the relevant information from each received beacon (see Figure 3.51 for the structure of the beacon payload) into its neighbor table (see Table 3.53 for the contents of a neighbor table entry)." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 306; *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 212-13, Figure 63.

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	Figure 3.51 Format of the MAC Sub-Layer Beacon Payload ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 362, Figure 3.51. "The beacon payload shall contain the information shown in Table 3.61. This enables the NWK layer to provide additional information to new devices that are performing network discovery and allows these new devices to more efficiently select a network and a particular neighbor to join." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 360.

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	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 360-61, Table 3.61. "ZigBee router: an IEEE 802.15.4 FFD participating in a ZigBee network, which is not the ZigBee coordinator but may act as an IEEE 802.15.4 coordinator within its personal operating space, that is capable of routing messages between devices and supporting associations." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 11.

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	"The responsibilities of the ZDO include defining the role of the device within the network (e.g., ZigBee coordinator or end device), initiating and/or responding to binding requests and establishing a secure relationship between network devices. The ZDO is also responsible for discovering devices on the network and determining which application services they provide" ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 17-18. "The ZigBee network layer (NWK) supports star, tree, and mesh topologies. In a star topology, the network is controlled by one single device called the ZigBee coordinator. The ZigBee coordinator is responsible for initiating and maintaining the devices on the network. All other devices, known as end devices, directly communicate with the ZigBee coordinator. In mesh and tree topologies, the ZigBee coordinator is responsible for starting the network and for choosing certain key network parameters, but the network may be extended through the use of ZigBee routers. In tree networks, routers move data and control messages through the network using a hierarchical routing strategy. Tree networks may employ beacon-oriented communication as described in the IEEE 802.15.4 specification." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 2. "ZigBee Device Objects are applications which employ network and application support layer primitives to implement ZigBee End Devices, ZigBee Routers, and ZigBee Coordinators" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 185. The Huawei '537 Patent Accused Products also incorporate communication units including configuration modules that determine a status of that communication unit as a routing unit, wherein that status is fixed for routing subsequent network messages and re-evaluated in response to changes in network connectivity. For example, and without limitation:

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	Zigbee and IEEE 802.15.4 standards describe and require that one device be fixed as an overall PAN controller, and that this status be re-evaluated via a contention resolution mechanism when changes in network connectivity result in multiple devices attempting to establish themselves as PAN coordinators. Other devices can be fixed as coordinators. Once established, the device status persists until, for example, there is a change in network connectivity. "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. ***Only one of these coordinators is the overall PAN coordinator***, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices. ***A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators*** . . ." IEEE Std 802.15.4-2011, at p. 10. "**personal area network (PAN) coordinator**: A coordinator that is the principal controller of a PAN. An IEEE 802.15.4 network has exactly one PAN coordinator." IEEE Std 802.15.4-2011, at p. 5. "In some instances a situation could occur in which two PANs exist in the same radio communications range with the same PAN identifier. If this conflict happens, the PAN coordinator and its devices shall perform the PAN identifier conflict resolution procedure." IEEE Std 802.15.4-2011, at p. 27. "On the detection of a PAN identifier conflict by the PAN coordinator, the MLME shall issue an MLME-SYNC-LOSS.indication to the next higher layer with the LossReason parameter set to PAN_ID_CONFLICT. The next higher layer of the PAN coordinator may then perform an active scan and, using the information from the scan, select a new PAN identifier. The algorithm for

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	selecting a suitable PAN identifier is outside the scope of this standard. If the next higher layer does select a new PAN identifier, it may then issue an MLME-START.request with the CoordRealignment parameter set to TRUE in order to realign the PAN, as described in 5.1.2.3" IEEE Std 802.15.4-2011, at p. 29. "If the device type is a ZigBee Router or ZigBee End Device, this function shall provide the ability to select an existing PAN to join and implement orphaning procedures which permit the device to re-associate with the same ZigBee Coordinator or ZigBee Router if network communication is lost. If the device type is a ZigBee Coordinator or ZigBee Router, this function shall provide the ability to select an unused channel for creation of a new PAN. Note that is possible to deploy a network without a device pre-designated as ZigBee Coordinator where the first Full Function Device (FFD) activated device assumes the role of ZigBee Coordinator." ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 135.

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	2.5.2.4 Network Manager This function shall implement the ZigBee Coordinator, ZigBee Router, or ZigBee End Device logical device types according to configuration settings established either via a programmed application or during installation. If the device type is a ZigBee Router or ZigBee End Device, this function shall provide the ability to select an existing PAN to join and implement procedures which permit the device to rejoin if network communication is lost. If the device type is a ZigBee Coordinator or ZigBee Router, this function shall provide the ability to select an unused channel for creation of a new PAN. Note that it is possible to deploy a network without a device pre-designated as ZigBee Coordinator where the first Full Function Device (FFD) activated assumes the role of ZigBee Coordinator. The following description covers processing addressed by Network Management: • Permits specification of a channel list for network scan procedures. Default is to specify use of all channels in the selected band of operation. • Manages network scan procedures to determine neighboring networks and the identity of their ZigBee coordinators and routers. • Permits selection of a channel to start a PAN (ZigBee Coordinator) or selection of an existing PAN to join (ZigBee Router or ZigBee End Device). • Supports orphaning and extended procedures to rejoin the network, including support for intra_PAN portability. • May support direct join. For ZigBee Coordinators and ZigBee Routers, a local version of direct join may be supported to enable the device to join via the orphaning or rejoin procedures. ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 189 "The responsibilities of the ZigBee NWK layer shall include mechanisms used to join and leave a network, to apply security to frames and to route frames to their intended destinations. In addition, the discovery and maintenance of routes between devices devolve to the NWK layer. Also the discovery of one-hop neighbors and the storing of pertinent neighbor information are done at the NWK layer. The NWK layer of a ZigBee coordinator (see 'Network topology') is responsible for starting a new network, when appropriate, and assigning addresses to newly associated devices"

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	ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 17-18. *Figure 3.43 Address Assignment in an Example Network* ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 325, Figure 3.43; *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 224, Figure 54.

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'537 PATENT CLAIM 31	INFRINGEMENT BY HUAWEI CORPORATION
31. The network of claim 30 wherein said each communication unit transmits messages in the form of radio signals.	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate a communications network including communication units (see Claim 30 above) wherein each communication unit transmits messages in the form of radio signals. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require transmission at certain frequency ranges in the radio spectrum: "The PHY layer operates in two separate frequency ranges: 868/915 MHz and 2.4 GHz. The lower frequency PHY layer covers both the 868 MHz European band and the 915 MHz band, used in countries such as the United States and Australia. The higher frequency PHY layer is used virtually worldwide." ZigBee Specification, Version r21 (Aug. 5, 2015), at 1. "Physical layers (PHYs) are defined for — Devices operating in the license-free 868–868.6 MHz, 902–928 MHz, and 2400–2483.5 MHz bands" IEEE Std 802.15.4-2011, at p. 1. "In a peer-to-peer topology, each device is capable of communicating with any other device within its radio communications range." IEEE Std 802.15.4-2011, at p. 9.

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	"An LR-WPAN device comprises at least one PHY, which contains the *radio frequency (RF) transceiver* along with its low-level control mechanism, and a MAC sublayer that provides access to the physical channel for all types of transfer." IEEE Std 802.15.4-2011, at p. 11

'537 PATENT CLAIM 33	INFRINGEMENT BY HUAWEI CORPORATION
33. In a communications network including a plurality of communication units to transmit and receive messages within said network, a method of transmitting and receiving messages comprising the steps of:	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate a communications network that includes communication units to transmit and receive messages, and do transmit and receive messages within the network. For example, and without limitation: The Huawei '537 Patent Accused Products comply with the Zigbee standards, including the IEEE 802.15.4 standard (defining the Medium Access Control (MAC) and Physical (PHY) sublayers for Low-Rate Wireless Personal Area Networks (LR-WPANs) connectivity), which is the basis for the MAC and PHY layers in Zigbee certified products. *See, e.g.*, Zigbee Alliance, Zigbee 3.0, *available at* https://www.zigbee.org/zigbee-for-developers/zigbee-3-0/ (last accessed March 27, 2019); *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 17-18; ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 1 ("The IEEE 802.15.4 standard defines the two lower layers: the physical (PHY) layer and the medium access control (MAC) sub-layer. The ZigBee Alliance builds on this foundation by providing the network (NWK) layer and the framework for the application layer."). Zigbee and IEEE 802.15.4 standards describe a wireless communication network comprising a number of mobile nodes that transmit and receive messages.

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	Figure 1—Star and peer-to-peer topology examples IEEE Standard for Local and Metropolitan Area Networks – Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs), IEEE Computer Society, IEEE Std 802.15.4-2011, at p. 9, Figure 1. "A system conforming to this standard consists of several components. The most basic is the device. Two or more devices communicating on the same physical channel constitute a WPAN." IEEE Std 802.15.4-2011, at p. 8. "In a peer-to-peer topology, *each device is capable of communicating with any other device within its radio communications range*. One device is nominated as the PAN coordinator, for instance, by virtue of being the first device to communicate on the channel."

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	IEEE Std 802.15.4-2011, at p. 9. "An LR-WPAN device comprises at least one PHY, which contains the radio frequency (RF) transceiver along with its low-level control mechanism, and a MAC sublayer that provides access to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11. "The PHY data service enables the transmission and reception of PHY protocol data units (PPDUs) across the physical radio channel. The general PHY requirements are described in Clause 8. The features of the PHY are activation and deactivation of the radio transceiver, ED, LQI, channel selection, clear channel assessment (CCA), and *transmitting as well as receiving packets across the physical medium*." IEEE Std 802.15.4-2011, at p. 11. *See* also Claim 30 preamble and claim element 30[a] above.
[a] periodically transmitting a unit status message from each communication unit;	The Huawei '537 Patent Accused Products incorporate communication units that periodically transmit unit status messages. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each LR-WPAN device to include a MAC sublayer, which manages the periodic transmission of beacon messages that communicate status information: "An LR-WPAN device comprises at least one PHY, which contains the radio frequency (RF) transceiver along with its low-level control mechanism, and a MAC sublayer that provides access

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	to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11. IEEE Std 802.15.4-2011, at p. 11, Figure 3 "The features of the MAC sublayer are *beacon management*, channel access, GTS management, frame validation, acknowledged frame delivery, association, and disassociation." IEEE Std 802.15.4-2011, at p. 11.

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	"Any FFD is able to act as a coordinator and provide *synchronization services* to other devices or other coordinators. . . . A candidate device receiving a beacon frame is able to request to join the network at the PAN coordinator. If the PAN coordinator permits the device to join, it adds the new device as a child device in its neighbor list. Then the newly joined device adds the PAN coordinator as its parent in its neighbor list and *begins transmitting periodic beacons*; other candidate devices are able to then join the network at that device. . . . The detailed procedures describing how a PAN is started and how devices join a PAN are found in 5.1.2 and 5.1.3." IEEE Std 802.15.4-2011, at p. 10.

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	Figure 2—Cluster tree network IEEE Std 802.15.4-2011, at p. 10, Figure 2. "The mechanisms for each transfer type depend on whether the network supports the transmission of periodic beacons. A beacon-enabled PAN is used in networks that either require synchronization or support for low latency devices, such as PC peripherals. If the network does not need synchronization or support for low latency devices, it can elect not to use the beacon for

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	normal transfers. However, the beacon is still required for network discovery. The structure of the frames used for the data transfer is specified in 5.2." IEEE Std 802.15.4-2011, at p. 13. "5.1.2.4 Beacon generation . . . All beacon frames, as defined in 5.2.2.1, shall be transmitted at the beginning of each superframe at an interval equal to *aBase-SuperframeDuration* $\times$ 2^n, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 31-32. "5.1.2.5 Device discovery The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery. . . . A beacon frame shall be transmitted at a rate of one beacon frame every *aBaseSuperframeDuration* $\times$ 2^n, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 32. *See* also claim element 30[b] above.
[b] adjusting the time between each periodic transmission of a communication unit in	The Huawei '537 Patent Accused Products incorporate communication units that adjust the time between each periodic transmission in response to detecting modifications in connectivity with neighboring units. For example, and without limitation:

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response to that communication unit detecting modifications in connectivity with neighboring units; and	Zigbee and IEEE 802.15.4 standards describe and require each LR-WPAN device to include a MAC sublayer, which manages the generation of periodic beacon messages, synchronizing to beacon messages from other nodes, and supporting association and disassociation of nodes from the network. For example, when a loss of connectivity to a neighboring "coordinator" node is detected, a device is instructed to adjust the beacon transmission interval to be based on its own internal settings, rather than the incoming beacons:

IEEE Std 802.15.4-2011, at p. 18

"The structure of this superframe is described by the values of *macBeaconOrder* and *macSuperframeOrder*. The MAC PIB attribute *macBeaconOrder* describes the **interval at which the coordinator shall transmit its beacon frames**. The value of *macBeaconOrder* and the **beacon interval**, *BI*, are related as follows:

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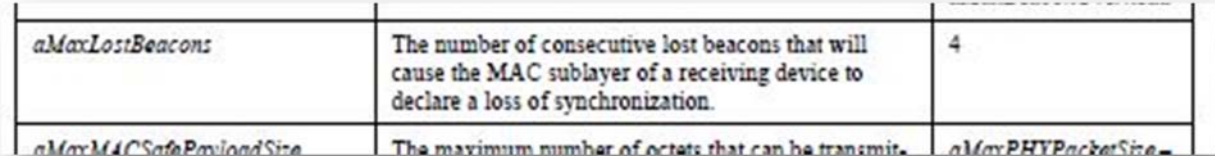| '537 PATENT CLAIM 33	INFRINGEMENT BY HUAWEI CORPORATION
	$BI = aBaseSuperframeDuration \times 2^{macBeaconOrder}$" IEEE Std 802.15.4-2011, at p. 18. "5.1.2.4 Beacon generation . . . All beacon frames, as defined in 5.2.2.1, shall be transmitted at the beginning of each superframe **at an interval** equal to *aBase-SuperframeDuration* $\times 2^n$, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 31-32. "5.1.2.5 Device discovery The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery. . . . A beacon frame shall be transmitted at a rate of one beacon frame every *aBaseSuperframeDuration* $\times 2^n$, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 32. "If a device misses between one and (*aMaxLostBeacons*–1) consecutive beacon frames from its coordinator, the device shall continue to transmit its own beacons based on both *macBeaconOrder*, as defined in 5.1.2.3.4, and its local clock. If the device then receives a beacon frame from its coordinator and, therefore, does not lose synchronization, the device shall resume transmitting its own beacons based on the StartTime parameter and the incoming beacon." IEEE Std 802.15.4-2011, at p. 32.

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'537 PATENT CLAIM 33	INFRINGEMENT BY HUAWEI CORPORATION
	IEEE Std 802.15.4-2011, at p. 125, Table 51. *See* also claim element 30[c] above.
[c] determining a status of said each communication unit as a routing unit for routing network traffic or as a member unit of a corresponding routing unit in accordance with information contained within received unit status messages, wherein said communication unit status as said routing unit is fixed for routing subsequent network messages and re-evaluated in response to changes in network connectivity.	The Huawei '537 Patent Accused Products incorporate communication units that determine a status of that communication unit as a routing unit for routing network traffic or as a member unit of a corresponding routing unit in accordance with information contained within received unit status messages. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each LR-WPAN device to include a MAC sublayer, which manages the association and disassociation of devices with the network. Devices may be a full-function device that may serve as a PAN coordinator or coordinator (e.g., a routing unit) or a reduced-function device that may only serve as an end device (e.g., a member unit). The coordinators determine the status of nodes by a procedure utilizing information from beacon messages.

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	5.1 MAC functional description The MAC sublayer handles all access to the physical radio channel and is responsible for the following tasks: — Generating network beacons if the device is a coordinator — Synchronizing to network beacons — Supporting PAN association and disassociation — Supporting device security — Employing the CSMA-CA mechanism for channel access — Handling and maintaining the GTS mechanism — Providing a reliable link between two peer MAC entities IEEE Std 802.15.4-2011, at p. 18. "There are two device types: a full-function device (FFD) and a reduced-function device (RFD). The FFD may operate in three modes serving as *a personal area network (PAN) coordinator, a coordinator,* or a device. An RFD shall only operate as *a device*." IEEE Std 802.15.4-2011, at p. 18. "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. *The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting*

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'537 PATENT CLAIM 33	INFRINGEMENT BY HUAWEI CORPORATION
	beacon frames to neighboring devices. A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators . . ." IEEE Std 802.15.4-2011, at p. 10. "Once predetermined application or network requirements are met, the first PAN coordinator instructs a device to become the PAN coordinator of a new cluster adjacent to the first one. Other devices gradually connect and form a multicluster network structure, such as the one seen in Figure 2. The lines in Figure 2 represent the parent-child relationships of the devices and not the communication flow." IEEE Std 802.15.4-2011, at p. 10. "Otherwise, the device shall copy the relevant information from each received beacon (see Figure 3.51 for the structure of the beacon payload) into its neighbor table (see Table 3.53 for the contents of a neighbor table entry)." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 306; *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 212-13, Figure 63.

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'537 PATENT CLAIM 33	INFRINGEMENT BY HUAWEI CORPORATION
	Figure 3.51 Format of the MAC Sub-Layer Beacon Payload

ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 362, Figure 3.51.

"The beacon payload shall contain the information shown in Table 3.61. This enables the NWK layer to provide additional information to new devices that are performing network discovery and allows these new devices to more efficiently select a network and a particular neighbor to join."

ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 360, Table 3.61.

"ZigBee router: an IEEE 802.15.4 FFD participating in a ZigBee network, which is not the ZigBee coordinator but may act as an IEEE 802.15.4 coordinator within its personal operating space, that is capable of routing messages between devices and supporting associations."

ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 11.

The Huawei '537 Patent Accused Products also incorporate communication units that determine a status of that communication unit as a routing unit, wherein that status is fixed for routing subsequent network |

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	messages and re-evaluated in response to changes in network connectivity. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that one device be fixed as an overall PAN controller, and that this status be re-evaluated via a contention resolution mechanism when changes in network connectivity result in multiple devices attempting to establish themselves as PAN coordinators. "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. ***Only one of these coordinators is the overall PAN coordinator***, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices. ***A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators*** . . ." IEEE Std 802.15.4-2011, at p. 10. "**personal area network (PAN) coordinator**: A coordinator that is the principal controller of a PAN. An IEEE 802.15.4 network has exactly one PAN coordinator." IEEE Std 802.15.4-2011, at p. 5. "In some instances a situation could occur in which two PANs exist in the same radio communications range with the same PAN identifier. If this conflict happens, the PAN coordinator and its devices shall perform the PAN identifier conflict resolution procedure." IEEE Std 802.15.4-2011, at p. 27. "On the detection of a PAN identifier conflict by the PAN coordinator, the MLME shall issue an MLME-SYNC-LOSS.indication to the next higher layer with the LossReason parameter set to PAN_ID_CONFLICT. The next higher layer of the PAN coordinator may then perform an active

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	scan and, using the information from the scan, select a new PAN identifier. The algorithm for selecting a suitable PAN identifier is outside the scope of this standard. If the next higher layer does select a new PAN identifier, it may then issue an MLME-START.request with the CoordRealignment parameter set to TRUE in order to realign the PAN, as described in 5.1.2.3" IEEE Std 802.15.4-2011, at p. 29. *See also* claim element 30[d] above.

'537 PATENT CLAIM 34	INFRINGEMENT BY HUAWEI CORPORATION
34. The method of claim 33 wherein said each communication unit transmits messages in the form of radio signals.	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate a communications network including communication units (*see* Claim 33 above) wherein each communication unit transmits messages in the form of radio signals. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require transmission at certain frequency ranges in the radio spectrum. *See* Claim 31 above.

'537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
36. A communications network comprising:	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate a communications network. For example, and without limitation:

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'537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
	Zigbee and IEEE 802.15.4 standards describe a wireless communication network comprising a number of mobile nodes that transmit and receive messages. Figure 1—Star and peer-to-peer topology examples IEEE Standard for Local and Metropolitan Area Networks – Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs), IEEE Computer Society, IEEE Std 802.15.4-2011, at p. 9, Figure 1. "A system conforming to this standard consists of several components. The most basic is the device. Two or more devices communicating on the same physical channel constitute a WPAN." IEEE Std 802.15.4-2011, at p. 8. *See also* Claim 30 preamble above.

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'537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
[a] a plurality of communication units forming a first network tier to transmit and receive messages within said network, wherein at least one of said communication units is designated as a routing unit to form a second network tier to route network traffic and at least one of said designated routing units is designated as a transmission routing unit to form a third network tier to transmit network information throughout said second and third network tiers, and wherein each said communication unit includes:	The Huawei '537 Patent Accused Products incorporate communication units that form a first network tier to transmit and receive messages within said network, wherein at least one of the communication units is designated as a routing unit to form a second network tier to route network traffic, and at least one of said designated routing units is designated as a transmission routing unit to form a third network tier to transmit network information throughout said second and third network tiers. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that devices with the network may be a full-function device that may serve as a PAN coordinator (e.g., a transmission routing unit) or coordinator (e.g., a routing unit) or a reduced-function device that may only serve as an end device (e.g., a first tier unit). "There are two device types: a full-function device (FFD) and a reduced-function device (RFD). The FFD may operate in three modes serving as *a personal area network (PAN) coordinator, a coordinator,* or a device. An RFD shall only operate as *a device*." IEEE Std 802.15.4-2011, at p. 18.

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'537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
	Figure 1—Star and peer-to-peer topology examples IEEE Std 802.15.4-2011, at p. 9, Figure 1. "An RFD connects to a cluster tree network as a leaf device at the end of a branch because RFDs do not allow other devices to associate. Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices. A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators . . ."

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'537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
	IEEE Std 802.15.4-2011, at p. 10. "The simplest form of a cluster tree network is a single cluster network, but larger networks are possible by forming a mesh of multiple neighboring clusters. Once predetermined application or network requirements are met, the first PAN coordinator instructs a device to become the PAN coordinator of a new cluster adjacent to the first one. Other devices gradually connect and form a multicluster network structure, such as the one seen in Figure 2. The lines in Figure 2 represent the parent-child relationships of the devices and not the communication flow." IEEE Std 802.15.4-2011, at p. 10.

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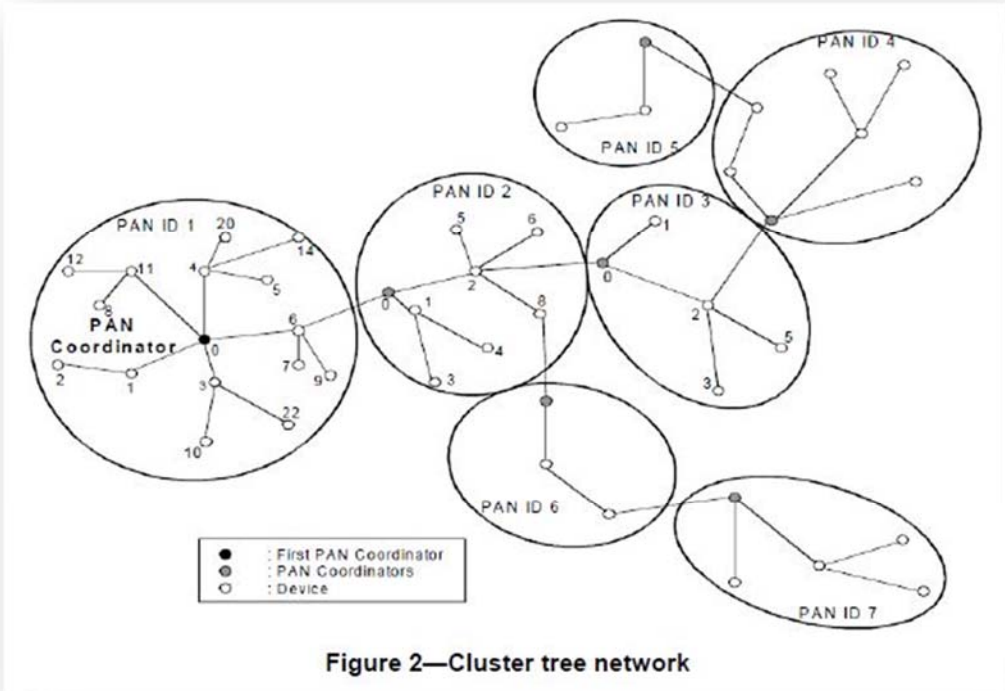
'537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
	Figure 2—Cluster tree network IEEE Std 802.15.4-2011, at p. 10, Figure 2
[b] a configuration module to determine a status of that communication unit as said routing unit of said second	The Huawei '537 Patent Accused Products incorporate communication units including configuration modules that determine a status of that communication unit as a routing unit of a second tier for routing network traffic or as a member unit of a first tier. For example, and without limitation:

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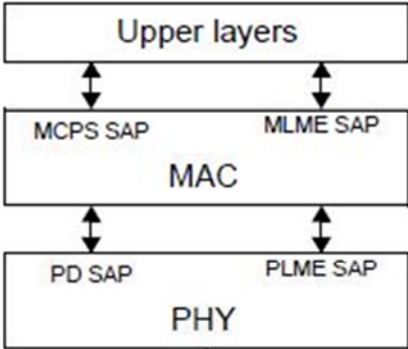| '537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
network tier for routing network traffic or as a member unit of said first network tier and associated with a routing unit, wherein said communication unit status as a routing unit is fixed for routing subsequent network messages;	Zigbee and IEEE 802.15.4 standards describe and require each LR-WPAN device to include a MAC sublayer, which manages the association and disassociation of devices with the network. Devices may be a full-function device that may serve as a PAN coordinator (e.g., a transmission routing unit) or coordinator (e.g., a routing unit) or a reduced-function device that may only serve as an end device (e.g., a first tier unit). "An LR-WPAN device comprises . . . a MAC sublayer that provides access to the physical channel for all types of transfer. Figure 3 shows these blocks in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2." IEEE Std 802.15.4-2011, at p. 11.

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	Figure 3—LR-WPAN device architecture IEEE Std 802.15.4-2011, at p. 11, Figure 3.

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	5.1 MAC functional description The MAC sublayer handles all access to the physical radio channel and is responsible for the following tasks: — Generating network beacons if the device is a coordinator — Synchronizing to network beacons — Supporting PAN association and disassociation — Supporting device security — Employing the CSMA-CA mechanism for channel access — Handling and maintaining the GTS mechanism — Providing a reliable link between two peer MAC entities IEEE Std 802.15.4-2011, at p. 18 "There are two device types: a full-function device (FFD) and a reduced-function device (RFD). The FFD may operate in three modes serving as a personal area network (PAN) coordinator, a coordinator, or a device. An RFD shall only operate as a device." IEEE Std 802.15.4-2011, at p. 18. "Any FFD is able to *act as a coordinator and provide synchronization services to other devices or other coordinators*. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon

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	frames to neighboring devices. A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators . . ."
	IEEE Std 802.15.4-2011, at p. 10 (emphasis added)
	"Once predetermined application or network requirements are met, the first PAN coordinator instructs a device to become the PAN coordinator of a new cluster adjacent to the first one. Other devices gradually connect and form a multicluster network structure, such as the one seen in Figure 2. The lines in Figure 2 represent the parent-child relationships of the devices and not the communication flow."
	IEEE Std 802.15.4-2011, at p. 10.
	"5.1.2.5 Device discovery
	The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery.
	A coordinator that is not the PAN coordinator shall begin transmitting beacon frames only when it has successfully associated with a PAN. The transmission of beacon frames by the device is initiated through the use of the MLME-START.request primitive with the PANCoordinator parameter set to FALSE."
	IEEE Std 802.15.4-2011, at p. 32.
	"Otherwise, the device shall copy the relevant information from each received beacon (see Figure 3.51 for the structure of the beacon payload) into its neighbor table (see Table 3.53 for the contents of a neighbor table entry)."

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	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 306; *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 212-13, Figure 63. Figure 3.51 Format of the MAC Sub-Layer Beacon Payload ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 362, Figure 3.51 "The beacon payload shall contain the information shown in Table 3.61. This enables the NWK layer to provide additional information to new devices that are performing network discovery and allows these new devices to more efficiently select a network and a particular neighbor to join." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 360.

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'537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 360-61, Table 3.61 "ZigBee router: an IEEE 802.15.4 FFD participating in a ZigBee network, which is not the ZigBee coordinator but may act as an IEEE 802.15.4 coordinator within its personal operating space, that is capable of routing messages between devices and supporting associations." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 11.

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	The Huawei '537 Patent Accused Products also incorporate communication units including configuration modules that determine a status of that communication unit as a routing unit, wherein that status as a routing unit is fixed for routing subsequent network messages. For example, and without limitation:
	
	Zigbee and IEEE 802.15.4 standards describe and require that one device be fixed as an overall PAN controller, while other devices can be fixed as coordinators. Once established, the device status persists until, for example, there is a change in network connectivity.
	
	    "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices."
	
	IEEE Std 802.15.4-2011, at p. 10.
	
	    "5.1.2.5 Device discovery
	
	    The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery.
	
	    A coordinator that is not the PAN coordinator shall begin transmitting beacon frames only when it has successfully associated with a PAN. The transmission of beacon frames by the device is initiated through the use of the MLME-START.request primitive with the PANCoordinator parameter set to FALSE."
	
	IEEE Std 802.15.4-2011, at p. 32.
	
	    "A coordinator shall allow association only if macAssociationPermit is set to TRUE. Similarly, a device should attempt to associate only with a PAN through a coordinator that is currently allowing

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	association, as indicated in the results of the scanning procedure. If a coordinator with macAssociationPermit set to FALSE receives an association request command from a device, the command shall be ignored. A device that is instructed to associate with a PAN, through the MLME-ASSOCIATE.request primitive, shall try to associate only with an existing PAN and shall not attempt to start its own PAN. The MAC sublayer of an unassociated device shall initiate the association procedure by sending an association request command, as described in 5.3.1, to the coordinator of an existing PAN; if the association request command cannot be sent due to a channel access failure, the MAC sublayer shall notify the next higher layer." IEEE Std 802.15.4-2011, at p. 33. "When a coordinator wants one of its associated devices to leave the PAN, the MLME of the coordinator shall send the disassociation notification command in the manner specified by the TxIndirect parameter of the MLME-DISASSOCIATE.request primitive previously sent by the next higher layer" IEEE Std 802.15.4-2011, at p. 34. "If the direct or indirect transmission fails, the coordinator should consider the device disassociated. If an associated device wants to leave the PAN, the MLME of the device shall send a disassociation notification command to its coordinator. If the disassociation notification command cannot be sent due to a channel access failure, the MAC sublayer shall notify the next higher layer. If the

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	acknowledgment to disassociation request is not received, the device should consider itself disassociated." IEEE Std 802.15.4-2011, at p. 36. "If a device misses between one and (*aMaxLostBeacons*–1) consecutive beacon frames from its coordinator, the device shall continue to transmit its own beacons based on both *macBeaconOrder*, as defined in 5.1.2.3.4, and its local clock. If the device then receives a beacon frame from its coordinator and, therefore, does not lose synchronization, the device shall resume transmitting its own beacons based on the StartTime parameter and the incoming beacon." IEEE Std 802.15.4-2011, at p. 32. IEEE Std 802.15.4-2011, at p. 125, Table 51. *See also* claim element 30[d] above.
[c] a routing unit configuration module to determine a status of that communication unit as a transmission routing unit in	The Huawei '537 Patent Accused Products incorporate communication units including routing unit configuration modules that determine a status of that communication unit as a transmission routing unit in response to that communication unit being designated as said routing unit. For example, and without limitation:

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response to that communication unit being designated as said routing unit, wherein said communication unit status as a transmission routing unit is fixed for flooding subsequent network connectivity messages; and	Zigbee and IEEE 802.15.4 standards describe and require that one device be fixed as an overall PAN controller, and that this status be re-evaluated via a contention resolution mechanism when changes in network connectivity result in multiple devices attempting to establish themselves as PAN coordinators. "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. ***Only one of these coordinators is the overall PAN coordinator***, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices. ***A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators . . .***" IEEE Std 802.15.4-2011, at p. 10. "**personal area network (PAN) coordinator**: A coordinator that is the principal controller of a PAN. An IEEE 802.15.4 network has exactly one PAN coordinator." IEEE Std 802.15.4-2011, at p. 5. *See also* claim element 30[d] above. The Huawei '537 Patent Accused Products incorporate routing unit configuration modules that fix the communication unit status as a transmission routing unit for flooding subsequent network connectivity messages. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that the PAN coordinator transmit beacons as well as Parent announcement messages (e.g., network connectivity messages). "Any FFD is able to act as a coordinator and provide *synchronization services* to other devices or other coordinators. . . . A candidate device receiving a beacon frame is able to request to join the network at the PAN coordinator. If the PAN coordinator permits the device to join, it adds the new

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	device as a child device in its neighbor list. Then the newly joined device adds the PAN coordinator as its parent in its neighbor list and ***begins transmitting periodic beacons***; other candidate devices are able to then join the network at that device. . . . The detailed procedures describing how a PAN is started and how devices join a PAN are found in 5.1.2 and 5.1.3." IEEE Std 802.15.4-2011, at p. 10. Figure 2—Cluster tree network IEEE Std 802.15.4-2011, at p. 10, Figure 2 "The mechanisms for each transfer type depend on whether the network supports the transmission of periodic beacons. A beacon-enabled PAN is used in networks that either require synchronization or support for low latency devices, such as PC peripherals. If the network does not need synchronization or support for low latency devices, it can elect not to use the beacon for

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	normal transfers. However, the beacon is still required for network discovery. The structure of the frames used for the data transfer is specified in 5.2." IEEE Std 802.15.4-2011, at p. 13. "5.1.2.4 Beacon generation . . . All beacon frames, as defined in 5.2.2.1, shall be transmitted at the beginning of each superframe at an interval equal to *aBase-SuperframeDuration* $\times$ 2^n, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 31-32. "5.1.2.5 Device discovery The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery. . . . A beacon frame shall be transmitted at a rate of one beacon frame every *aBaseSuperframeDuration* $\times$ 2^n, where *n* is the value of *macBeaconOrder*" IEEE Std 802.15.4-2011, at p. 32. "The Parent_annce is provided to enable ZigBee routers (including the coordinator) on the network to notify other ZigBee routers about all the end devices known to the local device. This command provides a means to resolve conflicts more quickly than aging out the child, when multiple routers purport to be the active parent of a particular end-device. The command may be broadcast from one router to all routers and the coordinator using the broadcast address 0xFFFC or unicast from one router to another router.

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'537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
	This message must be generated if all the following conditions are met: 1. The router or coordinator device has rebooted. 2. The router or coordinator is operating in the joined and authenticated state." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 94. "After processing all entries in the neighbor table, if the NumberOfChildren is greater than 0, then it shall send the message to the all routers broadcast address (0xFFFC)." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 95.
[d] an evaluation module to re-evaluate said communication unit status in response to connectivity changes in said network.	The Huawei '537 Patent Accused Products incorporate communication units including evaluation modules that re-evaluate the communication unit status in response to connectivity changes in the network. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that one device be fixed as an overall PAN controller, and that this status be re-evaluated via a contention resolution mechanism when changes in network connectivity result in multiple devices attempting to establish themselves as PAN coordinators. Other devices can be fixed as coordinators. Once established, the device status persists until, for example, there is a change in network connectivity. "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon

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	frames to neighboring devices. *A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators . . .*" IEEE Std 802.15.4-2011, at p. 10. "**personal area network (PAN) coordinator**: A coordinator that is the principal controller of a PAN. An IEEE 802.15.4 network has exactly one PAN coordinator." IEEE Std 802.15.4-2011, at p. 5. "In some instances a situation could occur in which two PANs exist in the same radio communications range with the same PAN identifier. If this conflict happens, the PAN coordinator and its devices shall perform the PAN identifier conflict resolution procedure." IEEE Std 802.15.4-2011, at p. 27. "On the detection of a PAN identifier conflict by the PAN coordinator, the MLME shall issue an MLME-SYNC-LOSS.indication to the next higher layer with the LossReason parameter set to PAN_ID_CONFLICT. The next higher layer of the PAN coordinator may then perform an active scan and, using the information from the scan, select a new PAN identifier. The algorithm for selecting a suitable PAN identifier is outside the scope of this standard. If the next higher layer does select a new PAN identifier, it may then issue an MLME-START.request with the CoordRealignment parameter set to TRUE in order to realign the PAN, as described in 5.1.2.3" IEEE Std 802.15.4-2011, at p. 29. "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN

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'537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
	coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices."
	IEEE Std 802.15.4-2011, at p. 10.
	"5.1.2.5 Device discovery
	The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery.
	A coordinator that is not the PAN coordinator shall begin transmitting beacon frames only when it has successfully associated with a PAN. The transmission of beacon frames by the device is initiated through the use of the MLME-START.request primitive with the PANCoordinator parameter set to FALSE."
	IEEE Std 802.15.4-2011, at p. 32.
	"A coordinator shall allow association only if *macAssociationPermit* is set to TRUE. Similarly, a device should attempt to associate only with a PAN through a coordinator that is currently allowing association, as indicated in the results of the scanning procedure. If a coordinator with *macAssociationPermit* set to FALSE receives an association request command from a device, the command shall be ignored.
	A device that is instructed to associate with a PAN, through the MLME-ASSOCIATE.request primitive, shall try to associate only with an existing PAN and shall not attempt to start its own PAN.
	The MAC sublayer of an unassociated device shall initiate the association procedure by sending an association request command, as described in 5.3.1, to the coordinator of an existing PAN; if the

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	association request command cannot be sent due to a channel access failure, the MAC sublayer shall notify the next higher layer." IEEE Std 802.15.4-2011, at p. 33. "When a coordinator wants one of its associated devices to leave the PAN, the MLME of the coordinator shall send the disassociation notification command in the manner specified by the TxIndirect parameter of the MLME-DISASSOCIATE.request primitive previously sent by the next higher layer" IEEE Std 802.15.4-2011, at p. 34. "If the direct or indirect transmission fails, the coordinator should consider the device disassociated. If an associated device wants to leave the PAN, the MLME of the device shall send a disassociation notification command to its coordinator. If the disassociation notification command cannot be sent due to a channel access failure, the MAC sublayer shall notify the next higher layer. If the acknowledgment to disassociation request is not received, the device should consider itself disassociated" IEEE Std 802.15.4-2011, at p. 36. "If a device misses between one and (*aMaxLostBeacons*–1) consecutive beacon frames from its coordinator, the device shall continue to transmit its own beacons based on both *macBeaconOrder*, as defined in 5.1.2.3.4, and its local clock. If the device then receives a beacon frame from its coordinator and, therefore, does not lose synchronization, the device shall resume transmitting its own beacons based on the StartTime parameter and the incoming beacon."

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	IEEE Std 802.15.4-2011, at p. 32. | aMaxLostBeacons	The number of consecutive lost beacons that will cause the MAC sublayer of a receiving device to declare a loss of synchronization.	4

aMaxMACSafePayloadSize	The maximum number of octets that can be transmit-	aMaxPHYPacketSize-	
			
			IEEE Std 802.15.4-2011, at p. 125, Table 51.
			
			"The Parent_annce is provided to enable ZigBee routers (including the coordinator) on the network to notify other ZigBee routers about all the end devices known to the local device. This command provides a means to resolve conflicts more quickly than aging out the child, when multiple routers purport to be the active parent of a particular end-device. The command may be broadcast from one router to all routers and the coordinator using the broadcast address 0xFFFC or unicast from one router to another router.
			
			This message must be generated if all the following conditions are met:
			
			    1. ***The router or coordinator device has rebooted***.
			
			    2. The router or coordinator is operating in the joined and authenticated state."
			
			ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 94.
			
			"After processing all entries in the neighbor table, if the NumberOfChildren is greater than 0, then it shall send the message to the all routers broadcast address (0xFFFC)."

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'537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 95. "If the device type is a ZigBee Router or ZigBee End Device, this function shall provide the ability to select an existing PAN to join and implement orphaning procedures which permit the device to re-associate with the same ZigBee Coordinator or ZigBee Router if network communication is lost. If the device type is a ZigBee Coordinator or ZigBee Router, this function shall provide the ability to select an unused channel for creation of a new PAN. Note that is possible to deploy a network without a device pre-designated as ZigBee Coordinator where the first Full Function Device (FFD) activated device assumes the role of ZigBee Coordinator." ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 135.

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'537 PATENT CLAIM 36	INFRINGEMENT BY HUAWEI CORPORATION
	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 189.

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'537 PATENT CLAIM 37	INFRINGEMENT BY HUAWEI CORPORATION
37. The network of claim 36 wherein said each communication unit transmits messages in the form of radio signals.	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate a communications network including communication units (see Claim 36 above) wherein each communication unit transmits messages in the form of radio signals. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require transmission of messages at certain frequency ranges in the radio spectrum. *See* Claim 31 above.

'537 PATENT CLAIM 38	INFRINGEMENT BY HUAWEI CORPORATION
38. The network of claim 36 wherein said configuration module further includes a unit designation module to examine network connectivity information relating to that communication unit and to designate that communication unit as said routing unit in response to that communication unit communicating with at least one neighboring unit that is isolated from communications with remaining neighboring	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate communication units including configuration modules (see Claim 36 above) that further include unit designation modules to examine network connectivity information relating to that communication unit and to designate that communication unit as said routing unit in response to that communication unit communicating with at least one neighboring unit that is isolated from communications with remaining neighboring units of that communication unit. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that devices capable of acting as coordinators (e.g. routing units) monitor communications from neighboring units to examine network connectivity information. Upon receiving communications from neighboring units that have become orphaned, or that wish to join, a device may become a new parent routing unit for that orphaned neighboring unit. For example, and without limitation: "An RFD connects to a cluster tree network as a leaf device at the end of a branch because RFDs do not allow other devices to associate. Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. Only one of these coordinators is

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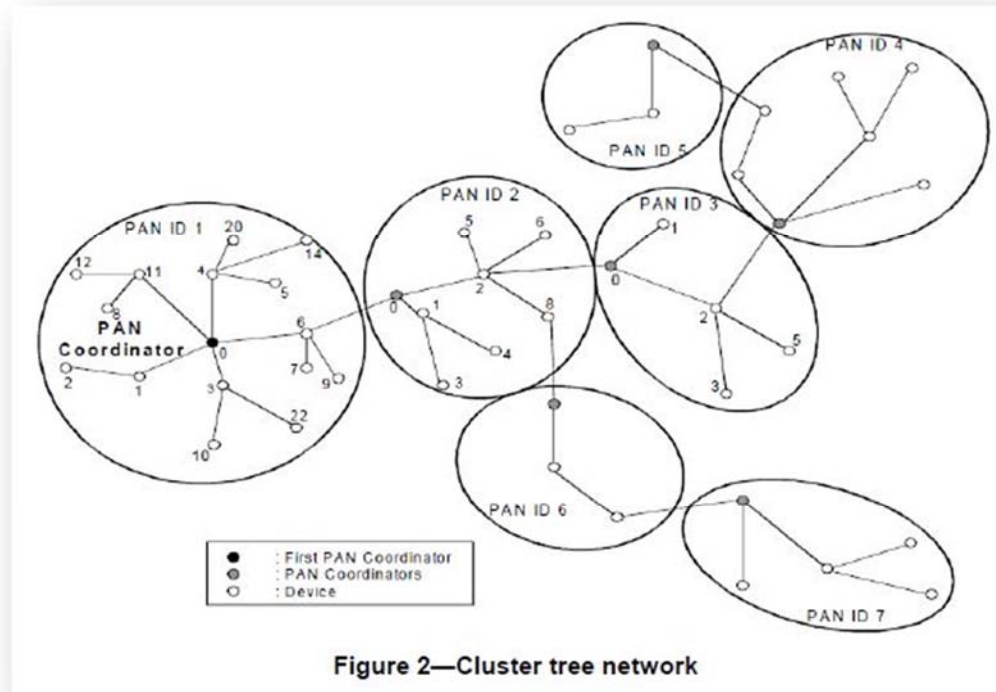
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units of that communication unit.	the overall PAN coordinator, potentially because it has greater computational resources than any other device in the PAN. The PAN coordinator forms the first cluster by choosing an unused PAN identifier and broadcasting beacon frames to neighboring devices. A contention resolution mechanism is required if two or more FFDs simultaneously attempt to establish themselves as PAN coordinators . . ." IEEE Std 802.15.4-2011, at p. 10. "The simplest form of a cluster tree network is a single cluster network, but larger networks are possible by forming a mesh of multiple neighboring clusters. Once predetermined application or network requirements are met, the first PAN coordinator instructs a device to become the PAN coordinator of a new cluster adjacent to the first one. Other devices gradually connect and form a multicluster network structure, such as the one seen in Figure 2. The lines in Figure 2 represent the parent-child relationships of the devices and not the communication flow." IEEE Std 802.15.4-2011, at p. 10.

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	Figure 2—Cluster tree network IEEE Std 802.15.4-2011, at p. 10, Figure 2. "ZigBee router: an IEEE 802.15.4 FFD participating in a ZigBee network, which is not the ZigBee coordinator but may act as an IEEE 802.15.4 coordinator within its personal operating space, that is capable of ***routing messages between devices and supporting associations***." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 11.

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'537 PATENT CLAIM 38	INFRINGEMENT BY HUAWEI CORPORATION
	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 189. "The ZigBee coordinator shall *maintain a list of currently associated devices* and facilitate *support of orphan scan and rejoin processing to enable previously associated devices to rejoin the network*. The ZigBee coordinator may support the ability for devices to be directly included in the network via the NLME-DIRECT-JOIN.request and NLME-DIRECT-JOIN.confirm. This feature shall permit lists of ZigBee IEEE addresses to be provided to the ZigBee coordinator and for those addresses to be included as previously associated devices. It shall be possible for ZigBee devices

2.5.2.4   Network Manager

This function shall implement the ZigBee Coordinator, ZigBee Router, or ZigBee End Device logical device types according to configuration settings established either via a programmed application or during installation. If the device type is a ZigBee Router or ZigBee End Device, this function shall provide the ability to select an existing PAN to join and implement procedures which permit the device to rejoin if network communication is lost. If the device type is a ZigBee Coordinator or ZigBee Router, this function shall provide the ability to select an unused channel for creation of a new PAN. Note that it is possible to deploy a network without a device pre-designated as ZigBee Coordinator where the first Full Function Device (FFD) activated assumes the role of ZigBee Coordinator. The following description covers processing addressed by Network Management:

- Permits specification of a channel list for network scan procedures. Default is to specify use of all channels in the selected band of operation.
- Manages network scan procedures to determine neighboring networks and the identity of their ZigBee coordinators and routers.
- Permits selection of a channel to start a PAN (ZigBee Coordinator) or selection of an existing PAN to join (ZigBee Router or ZigBee End Device).
- Supports orphaning and extended procedures to rejoin the network, including support for intra_PAN portability.
- May support direct join. For ZigBee Coordinators and ZigBee Routers, a local version of direct join may be supported to enable the device to join via the orphaning or rejoin procedures.

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'537 PATENT CLAIM 38	INFRINGEMENT BY HUAWEI CORPORATION
	with those addresses to directly join the network via orphaning or rejoin procedures rather than associating directly"
	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 193.
	"The ZigBee router shall *maintain a list of currently associated end devices* and facilitate *support of orphan scan and rejoin processing to enable previously associated end devices to rejoin the network*"
	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 195.

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'537 PATENT CLAIM 38	INFRINGEMENT BY HUAWEI CORPORATION
	2.5.4.5.4.1 Overview The operations described in this section are carried out by ZigBee Coordinator and ZigBee Router Devices for support of intra-PAN portability. The main steps are summarized as follows: • Detect the problem - The ZDO of the moved device is notified of acknowledgement failures via the NLME-NWK-STATUS.indication primitive, and identifies a problem. • Carry out the NWK layer rejoin procedure - The ZDO of a moved ZED initiates this process using the NLME-JOIN.request primitive, either through a secured or un-secured rejoining procedure. The NWK rejoin procedures closely mirror the MAC association procedure. Note that ZigBee Routers shall also carry out this procedure periodically if they find that they are no longer in contact with the Trust Center. • Security verification - Secured and unsecured protocol steps are described to ensure that the orphaned device should really be accepted. • Inform the rest of the network - when a device changes parents the steps to complete address conflict detection in section 3.6.1.9 must be completed. These actions also serve to notify the old parent that the End Device has changed parents. • Provide a means for parents that were temporarily unavailable and caused the end-device to rejoin are able to update their child tables once they are back online. ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 196. "This verification is carried out using existing commands. Section 2.5.4.5.4.3 below describes the transmission of a Device_annce command to the new parent. The new parent shall check that this or some other message is correctly formed and contains the addressing fields corresponding to the orphaned device. If security is enabled, then this command shall be secured with the network key, and the new parent shall verify that all security processing is carried out correctly. If all these checks succeed then the orphaned device shall become joined to the network. Otherwise, it shall not become joined to the network at this time. As normal, messages sent from a device not joined to the network shall not be forwarded across the network, and commands shall not be carried out.

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	Accordingly, the orphaned device shall only become joined to the network once it receives at least one correctly formed ZigBee message from the new parent." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 199. "This text describes the security operations for support of rejoining which are to be carried out by the ZigBee coordinator and by ZigBee routers that are already operating on the network. These devices will receive rejoin requests by orphaned devices and will act as follows. Following the steps described in section 2.5.4.5.2.2, an orphaned device (router or end device) shall be provisionally accepted onto the network by the coordinator or router for at least *apsSecurityTimeOutPeriod* milliseconds. During this period it shall be required to send at least one correctly formed ZigBee message secured with the network key to the new parent. If this message successfully passes all the security processing steps described in this document, it shall be accepted as a member of the network." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 435. "The procedure for a ZigBee coordinator or router to rejoin a device to its network using the NWK rejoin procedure is initiated by the arrival of a NWK layer rejoin command frame via the MAC data service. Only those devices that are either ZigBee coordinators or ZigBee routers shall initiate this procedure. If this procedure is initiated on any other device, the NLME shall terminate the procedure. When this procedure is in-itiated, the NLME of a potential parent shall first determine whether it already has knowledge of the re-questing device. To do this, the NLME shall search its neighbor table in order to determine whether a matching 64-bit, extended address can be found." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 315. "A device is notified of the presence of an orphaned device when it receives the MLME-ORPHAN.indication primitive from the MAC sub-layer. Only devices that are either ZigBee

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	coordinators or ZigBee routers (that is, devices with parental capabilities) shall initiate this procedure. If this procedure is initiated by any other device, the NLME shall terminate the procedure.

When this procedure is initiated, the NLME shall first determine whether the orphaned device is its child. This is accomplished by comparing the extended address of the orphaned device with the addresses of its children, as recorded in its neighbor table."

ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 318.

"The neighbor table of a device shall contain information on every device within transmission range, up to some implementation-dependent limit.

The neighbor table is useful in two contexts. First of all, it is used during network discovery or rejoining to store information about routers within RF reception range that may be candidate parents. Second, after the device has joined a network, it is used to store relationship and link-state information about neighboring devices in that network. A table entry shall be updated every time a device receives any frame from the corresponding neighbor."

ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 319.

"If a coordinator receives the orphan notification command, the MLME shall send the MLME.ORPHAN.indication primitive, as described in 6.2.7.1, to the next higher layer. The next higher layer should then search its device list for the device indicated by the primitive. If the next higher layer finds a record of the device, it should send a coordinator realignment command to the orphaned device using the MLME.ORPHAN.response primitive, as described in 6.2.7.2 . . ."

IEEE Std 802.15.4-2011, at p. 27 |

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	"If the next higher layer receives repeated communications failures following its requests to transmit data, it may conclude that it has been orphaned. . . . If the next higher layer concludes that it has been orphaned, it may instruct the MLME to either perform the orphaned device realignment procedure or reset the MAC sublayer and then perform the association procedure." IEEE Std 802.15.4-2011, at p. 39. "The startup procedure outlined in section 2.5.4.5.6.2 is designed in such a way that, by using it consistently, devices can go through all the stages of commissioning up to being joined to the proper ZigBee network and able to send and receive application data traffic. Later-stage commissioning, including the commissioning of bindings and group membership is discussed briefly in section 2.5.4.5.6.3" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 202. "Once a device is on a network and capable of communicating with other devices on the network in a secure manner, other commissioning becomes possible. Other items that should be subject to commissioning are shown in Table 2.144" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 203.

'537 PATENT CLAIM 39	INFRINGEMENT BY HUAWEI CORPORATION
39. The network of claim 36 wherein said routing unit configuration module further includes a routing unit	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate communication units including routing unit configuration modules (see Claim 36 above) that further include unit designation modules to examine network connectivity information relating to designated routing units and to designate that communication unit as a transmission routing unit in

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'537 PATENT CLAIM 39	INFRINGEMENT BY HUAWEI CORPORATION
designation module to examine network connectivity information relating to designated routing units stored within a link storage unit of that communication unit and to designate that communication unit as a transmission routing unit in response to that communication unit communicating with at least one neighboring routing unit that is isolated from communications with remaining neighboring routing units of that communication unit.	response to that communication unit communicating with at least one neighboring routing unit that is isolated from communications with remaining neighboring routing units of that communication unit. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that devices capable of acting as PAN coordinators (e.g. transmission routing units) monitor communications from neighboring units to examine network connectivity information. Upon receiving communications from neighboring units that have become orphaned, a device may become a new parent routing unit for that orphaned neighboring unit. For example, and without limitation: *See* Claim 38 above. Zigbee and IEEE 802.15.4 standards describe and require that network connectivity information be stored within a link storage unit. For example, and without limitation: "The neighbor table of a device shall contain information on every device within transmission range, up to some implementation-dependent limit. The neighbor table is useful in two contexts. First of all, it is used during network discovery or rejoining to store information about routers within RF reception range that may be candidate parents. Second, after the device has joined a network, it is used to store relationship and link-state information about neighboring devices in that network. A table entry shall be updated every time a device receives any frame from the corresponding neighbor." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 319. "A candidate device receiving a beacon frame is able to request to join the network at the PAN coordinator. If the PAN coordinator permits the device to join, it adds the new device as a child device in its neighbor list. Then the newly joined device adds the PAN coordinator as its parent in its neighbor list and begins transmitting periodic beacons; other candidate devices are able to then

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'537 PATENT CLAIM 39	INFRINGEMENT BY HUAWEI CORPORATION
	join the network at that device. If the original candidate device is not able to join the network at the PAN coordinator, it will search for another parent device." IEEE Std 802.15.4-2011, at p. 10.

'537 PATENT CLAIM 40	INFRINGEMENT BY HUAWEI CORPORATION
40. The network of claim 39 wherein said transmission routing unit transmits update messages including network connectivity information, and said routing unit configuration module further includes:	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products transmits update messages including network connectivity information. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that transmission routing units (e.g., PAN coordinators) transmit beacons that include network connectivity information. For example, and without limitation: "Any FFD is able to act as a coordinator and provide synchronization services to other devices or other coordinators. . . . A candidate device receiving a beacon frame is able to request to join the network at the PAN coordinator. If the PAN coordinator permits the device to join, it adds the new device as a child device in its neighbor list. Then the newly joined device adds the PAN coordinator as its parent in its neighbor list and ***begins transmitting periodic beacons***; other candidate devices are able to then join the network at that device. If the original candidate device is not able to join the network at the PAN coordinator, it will search for another parent device. The detailed procedures describing how a PAN is started and how devices join a PAN are found in 5.1.2 and 5.1.3." IEEE Std 802.15.4-2011, at p. 10.

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'537 PATENT CLAIM 40	INFRINGEMENT BY HUAWEI CORPORATION
	"5.1.2.4 Beacon generation . . . All beacon frames, as defined in 5.2.2.1, shall be transmitted at the beginning of each superframe at an interval equal to *aBase-SuperframeDuration* $\times\ 2^n$, where *n* is the value of *macBeaconOrder,*" IEEE Std 802.15.4-2011, at p. 31-32. "5.1.2.5 Device discovery The PAN coordinator or a coordinator indicates its presence on a PAN to other devices by transmitting beacon frames. This allows the other devices to perform device discovery. . . . A beacon frame shall be transmitted at a rate of one beacon frame every *aBaseSuperframeDuration* $\times\ 2^n$, where *n* is the value of *macBeaconOrder*." IEEE Std 802.15.4-2011, at p. 32. "Otherwise, the device shall copy the relevant information from each received beacon (see Figure 3.51 for the structure of the beacon payload) into its neighbor table (see Table 3.53 for the contents of a neighbor table entry)." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 306; *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 212-13, Figure 63.

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'537 PATENT CLAIM 40	INFRINGEMENT BY HUAWEI CORPORATION
	Figure 3.51 Format of the MAC Sub-Layer Beacon Payload ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 362, Figure 3.51. "The beacon payload shall contain the information shown in Table 3.61. This enables the NWK layer to provide additional information to new devices that are performing network discovery and allows these new devices to more efficiently select a network and a particular neighbor to join." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 360.

Figure 3.51 Format of the MAC Sub-Layer Beacon Payload

Bits: 0–7	8–11	12–15	16–17	18	19–22	23	24–87	88–111	112–119
Protocol ID	Stack profile	nwk cProtocol Version	Re-served	Router capacity	Device depth	End de-vice ca-pacity	nwk Extended PANId	Tx Offset	Nwk UpdateId

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'537 PATENT CLAIM 40	INFRINGEMENT BY HUAWEI CORPORATION
	  ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 360-61, Table 3.61

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'537 PATENT CLAIM 40	INFRINGEMENT BY HUAWEI CORPORATION
[a] a message forwarding module to receive an update message from a neighboring transmission routing unit in response to that communication unit being designated as said transmission routing unit and to transmit said received message to neighboring routing units of that communication unit to facilitate synchronization of said link storage unit of each said routing unit.	The Huawei '537 Patent Accused Products incorporate routing unit configuration modules including message forwarding modules that receive an update message from a neighboring device that has been designated as a transmission routing unit, and transmit that message to neighboring routing units to facilitate synchronization of link storage units (e.g., neighbor tables). For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require that devices continuously update their neighboring units with network connectivity information to facilitate synchronization of that information in each device's stored neighbor tables. For example, and without limitation: "Any FFD is able to act as a coordinator and provide *synchronization services to other devices or other coordinators*. . . . A candidate device receiving a beacon frame is able to request to join the network at the PAN coordinator. If the PAN coordinator permits the device to join, it adds the new device as a child device in its neighbor list. Then the newly joined device adds the PAN coordinator as its parent in its neighbor list and *begins transmitting periodic beacons*; other candidate devices are able to then join the network at that device. If the original candidate device is not able to join the network at the PAN coordinator, it will search for another parent device. The detailed procedures describing how a PAN is started and how devices join a PAN are found in 5.1.2 and 5.1.3." IEEE Std 802.15.4-2011, at p. 10. "A beacon-enabled PAN is used in networks that either require synchronization or support for low latency devices, such as PC peripherals. If the network does not need synchronization or support for low latency devices, it can elect not to use the beacon for normal transfers. However, the beacon is still required for network discovery. The structure of the frames used for the data transfer is specified in 5.2." IEEE Std 802.15.4-2011, at p. 13.

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'537 PATENT CLAIM 40	INFRINGEMENT BY HUAWEI CORPORATION
	"Otherwise, the device shall copy the relevant information from each received beacon (see Figure 3.51 for the structure of the beacon payload) into its neighbor table (see Table 3.53 for the contents of a neighbor table entry)." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 306. "The neighbor table of a device shall contain information on every device within transmission range, up to some implementation-dependent limit. The neighbor table is useful in two contexts. First of all, it is used during network discovery or rejoining to store information about routers within RF reception range that may be candidate parents. Second, after the device has joined a network, it is used to store relationship and link-state information about neighboring devices in that network. A table entry shall be updated every time a device receives any frame from the corresponding neighbor." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 319.

'537 PATENT CLAIM 45	INFRINGEMENT BY HUAWEI CORPORATION
45. In a communications network including a plurality of communication units forming a first network tier to transmit and receive messages within said network, wherein at least one of said communication units is	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate a communications network. *See* Claim 36 above. The Huawei '537 Patent Accused Products incorporate communication units that form a first network tier to transmit and receive messages within said network, wherein at least one of the communication units is designated as a routing unit to form a second network tier to route network traffic, and at least one of said

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'537 PATENT CLAIM 45	INFRINGEMENT BY HUAWEI CORPORATION
designated as a routing unit to form a second network tier to route network traffic and at least one of said designated routing units is designated as a transmission routing unit to form a third network tier to transmit network information throughout said second and third network tiers, a method of configuring said network including the steps of:	designated routing units is designated as a transmission routing unit to form a third network tier to transmit network information throughout said second and third network tiers. *See* claim element 36[a] above.
[a] determining a status of each communication unit as said routing unit of said second network tier for routing network traffic or as a member unit of said first network tier and associated with a routing unit, wherein said communication unit status as a routing unit is fixed for routing subsequent network messages;	*See* claim element 36[b] above.

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'537 PATENT CLAIM 45	INFRINGEMENT BY HUAWEI CORPORATION
[b] determining a status of each communication unit as said transmission routing unit to transmit said network information throughout said second and third network tiers in response to that communication unit being designated as said routing unit, wherein said communication unit status as a transmission routing unit is fixed for flooding subsequent network connectivity messages; and	*See* claim element 36[c] above.
[c] re-evaluating said communication unit status in response to connectivity changes in said network.	*See* claim element 36[d] above.

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'537 PATENT CLAIM 46	INFRINGEMENT BY HUAWEI CORPORATION
46. The method of claim 45 wherein said each communication unit transmits messages in the form of radio signals.	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate a communications network including communication units (see Claim 36 above) wherein each communication unit transmits messages in the form of radio signals. *See* Claim 31 above.

'537 PATENT CLAIM 47	INFRINGEMENT BY HUAWEI CORPORATION
47. The method of claim 45 wherein step (a) further includes:	The Huawei '537 Patent Accused Products infringe this claim.
[a] (a.1) examining network connectivity information relating to each communication unit and designating as said routing unit each communication unit communicating with at least one neighboring unit isolated from communications with remaining neighboring units of that communication unit.	*See* Claim 38 above.

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'537 PATENT CLAIM 48	INFRINGEMENT BY HUAWEI CORPORATION
48. The method of claim 45 wherein step (b) further includes:	The Huawei '537 Patent Accused Products infringe this claim.
[a] (b.1) examining network connectivity information relating to designated routing units and stored within a link storage unit of said each communication unit and designating as said transmission routing unit each communication unit that communicates with at least one neighboring routing unit isolated from communications with remaining neighboring routing units of that communication unit.	*See* Claim 39 above.

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'537 PATENT CLAIM 49	INFRINGEMENT BY HUAWEI CORPORATION
49. The method of claim 48 wherein said transmission routing unit transmits update messages including network connectivity information, and step (b) further includes:	The Huawei '537 Patent Accused Products infringe this claim. See Claim 40 above.
[a] (b.2) receiving an update message from a corresponding neighboring transmission routing unit at each communication unit designated as said transmission routing unit and transmitting said received message to neighboring routing units of that communication unit to facilitate synchronization of said link storage unit of each said routing unit.	*See* claim element 40[a] above.

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'537 PATENT CLAIM 54	INFRINGEMENT BY HUAWEI CORPORATION
54. In a wireless communications network including a plurality of communication units, wherein at least one of those units is designated as a member unit for transmitting and receiving messages and at least one of those units is designated as a relay unit for transferring messages from said member units, a communication unit to transmit and receive messages within said network comprising:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 1 above.
[a] a transmitter to transmit an outgoing message in the form of radio signals to each neighboring unit of said communication unit;	*See* claim element 1[a] and Claim 2 above.

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'537 PATENT CLAIM 54	INFRINGEMENT BY HUAWEI CORPORATION
[b] a receiver to receive an incoming message in the form of radio signals from said each neighboring unit;	*See* claim element 1[b] and Claim 3 above.
[c] a storage unit to store network information relating to said communication unit and corresponding neighboring units; and	*See* claim element 1[c] above.
[d] a processor to control said transmission and reception of said outgoing and incoming messages, wherein said processor includes:	*See* claim element 1[d] above.
[e] a configuration module to designate a status of said communication unit as one of said relay unit and said member unit to configure said communications network,	*See* claim element 1[e] above.

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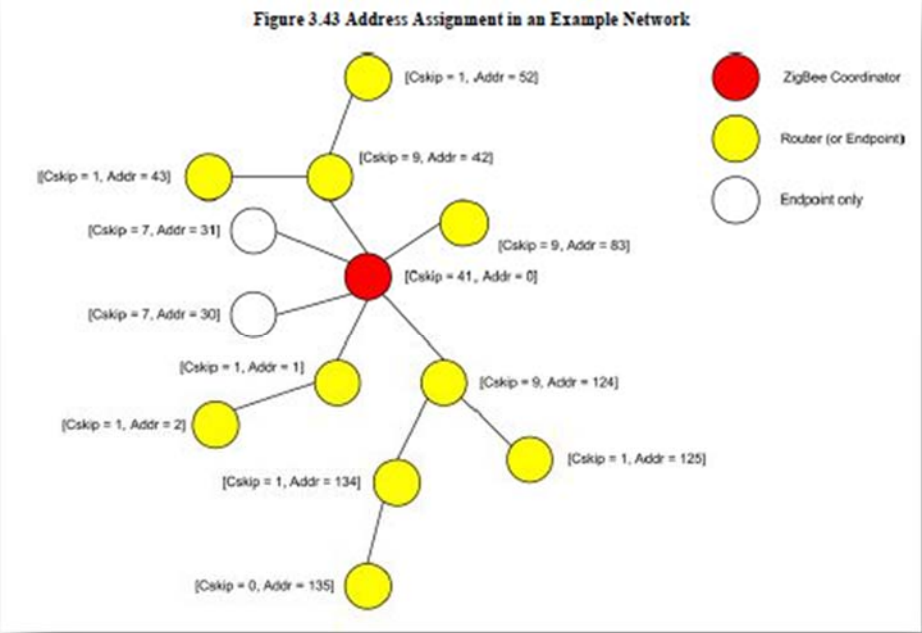| '537 PATENT CLAIM 54	INFRINGEMENT BY HUAWEI CORPORATION
wherein said configuration module includes:	
[f] a neighbor module to examine network connectivity information and identify at least one neighboring unit of said communication unit that is required to utilize said communication unit to communicate with network communication units that are outside the range of and greater than one hop away from that neighboring unit;	The Huawei '537 Patent Accused Products incorporate a communication unit including a neighbor module to examine network connectivity information and identify at least one neighboring unit of the communication unit that is required to utilize said communication unit to communicate with network communication units that are outside the range of and greater than one hop away from that neighboring unit. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each device to include a neighbor table storing network connectivity information relating to that device and its neighbors. Examination of that table permits the device to identify which neighbors must use the device to communicate with other devices that are more than one hop away. For example, and without limitation: "The neighbor table of a device shall contain information on every device within transmission range, up to some implementation-dependent limit. The neighbor table is useful in two contexts. First of all, it is used during network discovery or rejoining to store information about routers within RF reception range that may be candidate parents. Second, after the device has joined a network, it is used to ***store relationship and link-state information about neighboring devices in that network***. A table entry shall be updated every time a device receives any frame from the corresponding neighbor." ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 319.

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'537 PATENT CLAIM 54	INFRINGEMENT BY HUAWEI CORPORATION
	"The responsibilities of the ZigBee NWK layer shall include mechanisms used to join and leave a network, to apply security to frames and to route frames to their intended destinations. In addition, the discovery and maintenance of routes between devices devolve to the NWK layer. Also ***the discovery of one-hop neighbors and the storing of pertinent neighbor information*** are done at the NWK layer. The NWK layer of a ZigBee coordinator (see 'Network topology') is responsible for starting a new network, when appropriate, and assigning addresses to newly associated devices" ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 17-18.

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'537 PATENT CLAIM 54	INFRINGEMENT BY HUAWEI CORPORATION
	Figure 3.43 Address Assignment in an Example Network ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 325, Figure 3.43; *see also* ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 224, Figure 54. *See* claim element 1[f] above.

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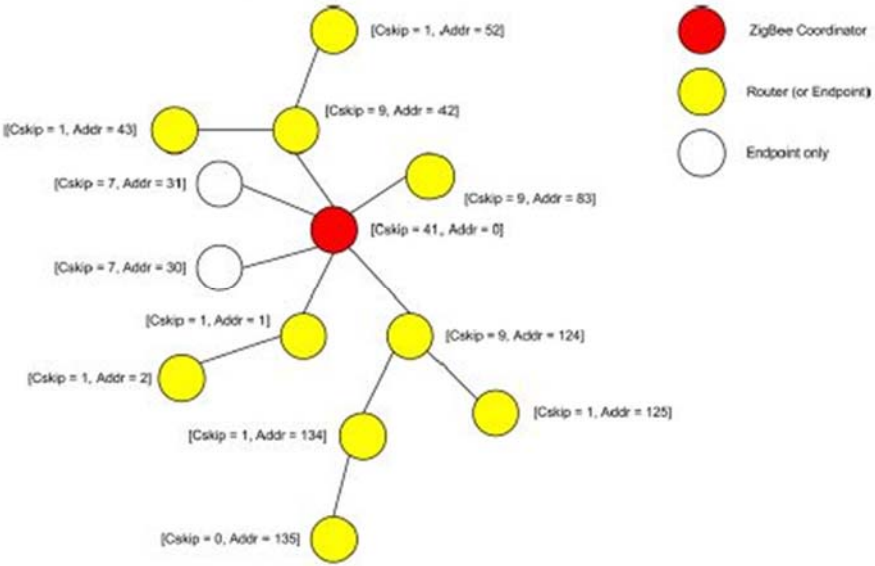| '537 PATENT CLAIM 54	INFRINGEMENT BY HUAWEI CORPORATION
[g] a designation module to designate said communication unit as said relay unit based on said examination and in response to determining that at least one neighboring communication unit is required to utilize said communication unit to communicate with network communication units that are outside the range of and greater than one hop away from said neighboring communication unit, wherein said communication unit designation as said relay unit is fixed for transferring subsequent network messages; and	The Huawei '537 Patent Accused Products incorporate a designation module to designate the communication unit as a relay unit based on the examination and in response to determining that at least one neighboring communication unit is required to utilize said communication unit to communicate with network communication units that are outside the range of and greater than one hop away from the neighboring communication unit. For example, and without limitation: Zigbee and IEEE 802.15.4 standards describe and require each router-capable device to identify which neighbors must use the device to communicate with other devices that are more than one hop away, and to become a parent routing unit (e.g. relay unit) for such devices. For example, and without limitation: "The responsibilities of the ZigBee NWK layer shall include mechanisms used to join and leave a network, to apply security to frames and to route frames to their intended destinations. In addition, the discovery and maintenance of routes between devices devolve to the NWK layer. Also ***the discovery of one-hop neighbors and the storing of pertinent neighbor information*** are done at the NWK layer. The NWK layer of a ZigBee coordinator (see 'Network topology') is responsible for starting a new network, when appropriate, and assigning addresses to newly associated devices" ZigBee Alliance, ZigBee Specification, Version r06 (June 27, 2005), at 17-18. "These addresses are unique within a particular network and are ***given by a parent to its children***. The ZigBee coordinator determines the maximum number of children any device, within its network, is allowed. Of these children, a maximum of *nwkMaxRouters* can be router-capable devices. The remaining devices shall be reserved for end devices. Every device has an associated depth that indicates the minimum number of hops a transmitted frame must travel, using only parent-child links, to reach the ZigBee coordinator. The ZigBee coordinator itself has a depth of 0, while its children have a depth of 1. Multi-hop networks have a maximum depth that is greater than 1. The ZigBee coordinator also determines the maximum depth of the network."

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'537 PATENT CLAIM 54	INFRINGEMENT BY HUAWEI CORPORATION
	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 323. ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 325, Figure 3.43. "**Neighbor discovery**: this is the ability to discover, record, and report information pertaining to the one-hop neighbors of a device. **Route discovery**: this is the ability to discover and record paths through the network, whereby messages may be efficiently routed."

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'537 PATENT CLAIM 54	INFRINGEMENT BY HUAWEI CORPORATION
	ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 220. "Second, if protection from theft of service is required (i.e., from malevolent network devices), NWK layer security shall be used for all frames, except those passed between a router and a newly joined device (until the newly joined device receives the active network key). Thus, only a device that has joined the network and successfully received the active network key will be able to have its messages communicated more than one hop across the network" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 376. *See* claim element 1[g] above.
[h] an evaluation module to re-evaluate said communication unit designation in response to connectivity changes in said network.	*See* claim element 1[h] above.

'537 PATENT CLAIM 55	INFRINGEMENT BY HUAWEI CORPORATION
55. The unit of claim 54, wherein said network is an ad-hoc wireless communications network.	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate an ad-hoc wireless communications network. For example, and without limitation:

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'537 PATENT CLAIM 55	INFRINGEMENT BY HUAWEI CORPORATION
	Zigbee and IEEE 802.15.4 standards describe and require a wireless network wherein devices can join and leave the network on an ad hoc basis. For example, and without limitation: "Keywords: ad hoc network, IEEE 802.15.4, low data rate, low power, LR-WPAN, mobility, PAN, personal area network, radio frequency, RF, short range, wireless, wireless personal area network, WPAN" IEEE Std 802.15.4-2011, at p. ii. "To illustrate, wireless networks rely on the ability for autonomous devices to join a network and discover other devices and services on devices within the network. Device and service discovery are features supported within the device profile" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 63. "*ad hoc* network devices" ZigBee Alliance, ZigBee Specification, Version r21 (Aug. 5, 2015), at 376.

'537 PATENT CLAIM 56	INFRINGEMENT BY HUAWEI CORPORATION
56. The unit of claim 54, wherein said processor further includes:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 54 above.

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'537 PATENT CLAIM 56	INFRINGEMENT BY HUAWEI CORPORATION
[a] a status transmission module to facilitate transmission of a unit status message at a periodic time interval, wherein said unit status message includes network connectivity information.	*See* claim element 4[a] above.

'537 PATENT CLAIM 57	INFRINGEMENT BY HUAWEI CORPORATION
57. The unit of claim 56, wherein said processor further includes:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 56 above.
[a] an interval module to adjust said periodic time interval to accommodate network conditions.	*See* Claim 5 above.

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Exhibit C – U.S. Patent No. 6,980,537 ('537) – Claims 1-5, 10-11, 16-19, 24-25, 30-31, 33-34, 36-40, 45-49, 54-68

'537 PATENT CLAIM 58	INFRINGEMENT BY HUAWEI CORPORATION
58. The unit of claim 54, wherein said plurality of communication units include said member units and said designated relay units, and wherein said relay units generate and forward network connectivity information through said network.	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 54 above. *See* claim element 11[a] above.

'537 PATENT CLAIM 59	INFRINGEMENT BY HUAWEI CORPORATION
59. In a wireless communications network including a plurality of communication units, wherein at least one of those units is designated as a member unit for transmitting and receiving messages and at least one of those units is designated as a relay unit for transferring messages from said member units, a method of configuring a network communication	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 16 above.

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'537 PATENT CLAIM 59	INFRINGEMENT BY HUAWEI CORPORATION
unit to transmit and receive messages within said network comprising the steps of:	
[a] examining network connectivity information relating to said communication unit and corresponding neighboring units stored in a storage unit of said communication unit and identifying at least one neighboring unit of said communication unit that is required to utilize said communication unit to communicate with network communication units that are outside the range of and greater than one hop away from that neighboring unit;	*See* claim elements 16[a] and 55[f] above.
[b] designating said communication unit as said	*See* claim elements 16[b] and 55[g] above.

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'537 PATENT CLAIM 59	INFRINGEMENT BY HUAWEI CORPORATION
relay unit based on said examination and in response to determining that at least one neighboring communication unit is required to utilize said communication unit to communicate with network communication units that are outside the range of and greater than one hop away from said neighboring communication unit, wherein said communication unit designation as said relay unit is fixed for transferring subsequent network messages; and	
[c] re-evaluating said communication unit designation in response to connectivity changes in said network.	*See* claim element 16[c] above.

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'537 PATENT CLAIM 60	INFRINGEMENT BY HUAWEI CORPORATION
60. The method of claim 59, wherein said network is an ad-hoc wireless communications network.	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 55 above.

'537 PATENT CLAIM 61	INFRINGEMENT BY HUAWEI CORPORATION
61. The method of claim 59, wherein step (a) further includes:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 59 above.
[a] (a.1) transmitting a unit status message at a periodic time interval, wherein said unit status message includes network connectivity information.	*See* claim element 56[a] above.

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'537 PATENT CLAIM 62	INFRINGEMENT BY HUAWEI CORPORATION
62. The method of claim 61, wherein step (a) further includes:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 61 above.
[a] (a.2) adjusting said periodic time interval to accommodate network conditions.	*See* claim element 57[a] above.

'537 PATENT CLAIM 63	INFRINGEMENT BY HUAWEI CORPORATION
63. The method of claim 59, wherein said plurality of communication units include said member units and said designated relay units, and said method further includes: (d) generating and forwarding network connectivity information through said network via said designated relay units.	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 59 above. *See* claim element 11[a] above.

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'537 PATENT CLAIM 64	INFRINGEMENT BY HUAWEI CORPORATION
64. A wireless communications network comprising:	The Huawei '537 Patent Accused Products infringe this claim. The Huawei '537 Patent Accused Products incorporate a wireless communications network. *See* Claim 54 above.
[a] a plurality of communication units to transmit and receive messages in the form of radio signals within said network, wherein said communication units: examine network connectivity information; identify communication units that are required to be utilized by associated neighboring units to communicate with network communication units that are outside the range of and greater than one hop away from those neighboring units; designate at least one communication unit as a relay unit to transfer network information based on said examination and in response to determining that said at least one communication unit	*See* claim elements 54[a] and 54[b] above. *See* claim elements 59[a], 59[b], and 59[c] above.

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'537 PATENT CLAIM 64	INFRINGEMENT BY HUAWEI CORPORATION
is required to be utilized by at least one neighboring unit to communicate with communication units that are outside the range of and greater than one hop away from said neighboring units, wherein said communication unit designation as said relay unit is fixed for transferring subsequent network messages; and re-evaluate said communication unit designation in response to connectivity changes in said network.	

'537 PATENT CLAIM 65	INFRINGEMENT BY HUAWEI CORPORATION
65. The network of claim 64, wherein said network is an ad-hoc wireless communications network.	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 55 above.

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'537 PATENT CLAIM 66	INFRINGEMENT BY HUAWEI CORPORATION
66. The network of claim 64, wherein said communication units each include:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 64 above.
[a] a status transmission module to facilitate transmission of a unit status message at a periodic time interval, wherein said unit status message includes network connectivity information.	*See* claim element 4[a] above.

'537 PATENT CLAIM 67	INFRINGEMENT BY HUAWEI CORPORATION
67. The network of claim 66, wherein said communication units each further include:	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 66 above.
[a] an interval module to adjust said periodic time interval to accommodate network conditions.	*See* Claim 5 above.

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'537 PATENT CLAIM 68	INFRINGEMENT BY HUAWEI CORPORATION
68. The network of claim 64, wherein said designated relay units generate and forward network connectivity information through said network.	The Huawei '537 Patent Accused Products infringe this claim. *See* Claim 64 above. *See* claim element 11[a] above.